ENGINEERING NEWS-RECORD

MBER 9, 1943

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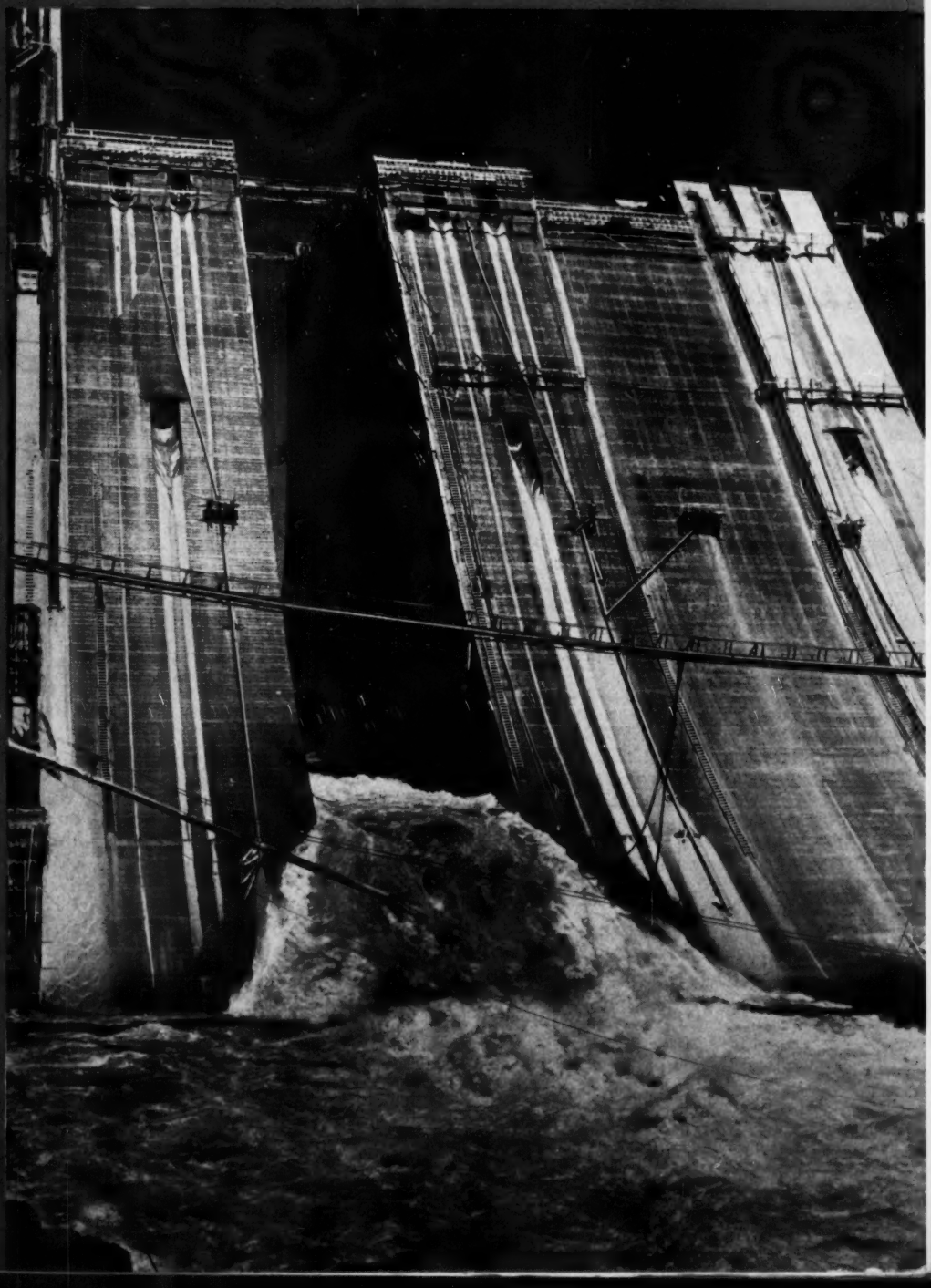

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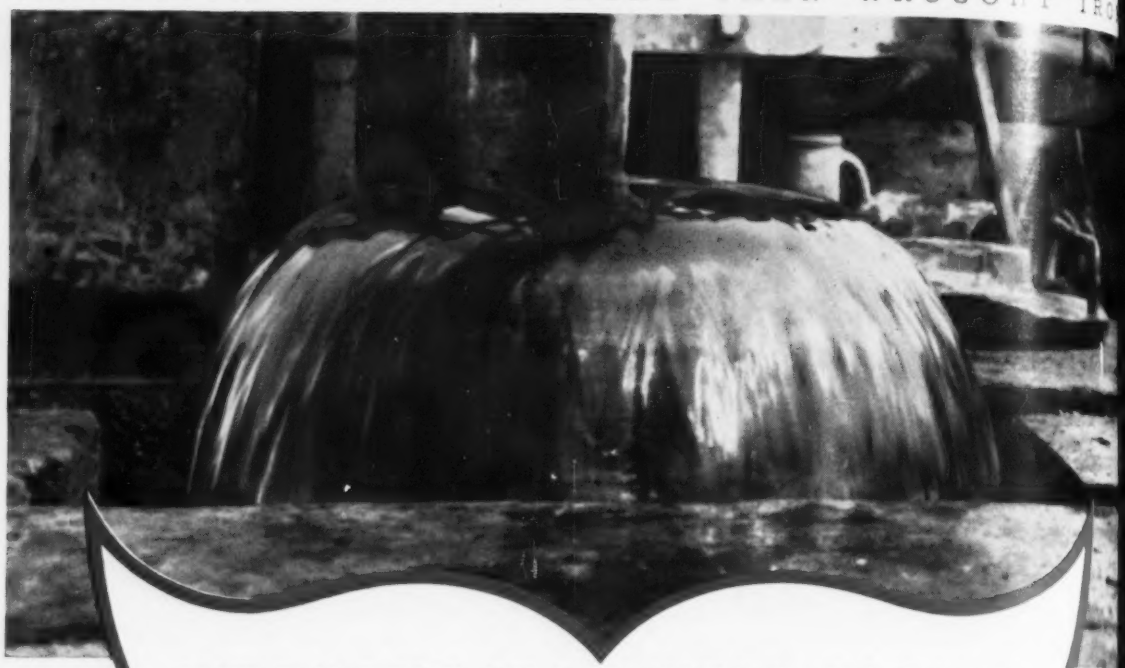

WROUGHT IRON WELL CASING

helps guard this Sturgeon Bay (Wis.) water supply

Two hundred and eighty-eight feet of Byers Wrought Iron 12" casing is handling the million-gallon-per-day flow from this recently drilled artesian well at Sturgeon Bay, Wis. The driller was Jos. Egerer, Milwaukee, Wis.; Superintendent of Public Utilities, Jess B. Johnson; Geologist, Rufus Mather Bagg, Ph.D., Appleton, Wis.

This installation is of particular interest, for it demonstrates that genuine wrought iron well casing can be obtained on projects properly rated. The Government has even found it advisable to adopt a more liberal policy with respect to individual wells. Preference Order M-330, Part 1029, issued June 1, 1943, and PR 19, Part 944, dated June 8, place wrought iron well casing on the "permitted" list of farm supplies.

No engineer need be reminded of the importance of durability in well casing; failure may cause pollution. And no engineer familiar with wrought iron needs to be told about its dependability. Wrought iron well casing is still

serving in dozens of localities after 2
30, and 40 years, with no sign of failu
One industrial concern in Ohio h
to replace casings of ordinary mater
every two years. They switched
wrought iron . . . and in the succeedi
10 years had no further casing troubl

Unusual service like this calls f
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and from soil. Wrought iron's succe
is the direct result of its two-compone
structure: high-purity iron, and t
millions of tiny glass-like slag fibe
that are threaded through it. Corros
attack is not only resisted, but diffuse
Our Engineering Service Departm
has a large file of performance record
and will be glad to pass this informati
on to you as a help in your specifyi
You will also find some interesting da
in our bulletin, "Wrought Iron
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WALDO G. BOWMAN, *Editor* ALBERT E. PAXTON, *Manager*

Vol. 131 SEPTEMBER 9, 1943 No. 11

COMING NEXT

• Along a 3,500 mile dog-leg strip of North Africa from Casablanca in French Morocco to Asmara in once-Italian Eritrea, thousands of U. S. engineers and construction men, since 1942, have marched and fought, built airdromes and roads, cleared minefields and harbors, constructed depots, shops and camps. As members of our armed forces and as civilians, their work is a record of outstanding achievement. As *ENR*'s war correspondent in the Middle East Theatre of Operations, Waldo G. Bowman, tells a fascinating story of these achievements in the Sept. 23 issue.

• Now under construction in Costa Rica is that country's largest hydro-electric power development, the fourth to be built on the Virilla River. When completed this year the project will add 50 percent to the water power output of this Central American republic. A. N. Carter, *ENR* assistant editor, who reported on the Inter-American Highway work in recent issues, will describe the project in the Sept. 23, issue.

• Three interesting new waterworks projects will be featured in the Sept. 23 issue. A pumping station at Detroit designed to house four 40-mgd. pumping units, a reservoir intake of unusual construction, about one mile of large main, and installation of two of the four pumping units were all completed within a ten week period. A 600,000-gal. capacity reservoir at Springfield, Vt., has walls, columns, and a groined arch roof of unreinforced concrete. At Chicago, several hundred feet of 36-in. diameter, wire-wound, prestressed concrete pipe for a feeder main has successfully withstood a hydraulic pressure of 200 psi.

LOOKING AHEAD

• Competition to provide more economical design of munition storage facilities, stimulated by introduction of the beehive-dome magazine about 18 months ago, has resulted in simplification of design and reduction of metal in both the standard igloo and beehive types of magazines. Recently, both types of magazines, in groups of three, have been built by the Navy thus affording an opportunity to study and compare designs and construction methods. The two types will be discussed in an early issue.

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The Week In Engineering and Construction

ENGINEERING NEWS-RECORD • SEPTEMBER 9, 1943 • VOLUME 131 • NUMBER 11

Construction workers needed for gasoline plant program

Expansion of program for 100-octane gasoline production calls for 183 new plants which will require 11,500 construction workers in the near future

By October or the first of November, 11,500 additional construction workers will be needed to fill peak requirements for the 100-octane aviation gasoline construction program already being retarded because of manpower shortage.

Needs have been determined by a survey made by the recently formed Construction Section of the Refining Division of the Petroleum Administration for War (*ENR*, Aug. 26, p. 312).

The most critical labor shortage is in the Gulf Coast area, where 6,000 workers will be needed. Next is the Middle West section of the country, which it is estimated will require 2,500. The Pacific Coast comes third in urgency of need, requiring 2,000 workers. The Rocky Mountain states are scheduled to need 1,000 men. East Coast states' requirements are small, mainly because of the few plants scheduled for that region.

In an effort to steer workers to this critical construction work, the War Production Board has established a labor priority rating for the work, on a par with construction labor for plants for airplanes and parts, escort vessels, and rubber manufacture.

The most critical need is for pipe fitters, pipe fitter welders, common labor, asbestos workers, and high test welders. Despite the fact that the manpower shortage is already retarding construction, even before the greater part of the program gets under way, it is believed that the cooperative efforts of the trades unions, the United States Employment Service, and the local committees appointed by Petroleum Administration for War to help procure the necessary labor, will locate and, if necessary, transport sufficient labor, particularly if contractors are prompt about making their needs known.

Most acute shortages are reported in the areas about Los Angeles, Port Arthur, and Houston. The greatest scarcity occurs in the Houston area, where there is particular difficulty in getting enough high test welders. In order to alleviate the condition there, it has been suggested that contractors in that district cooperate in scheduling jobs—despite the inconvenience involved—so that the same labor can go from job to job. The program includes proposed changes, additions or new construction at 183 plants for which designs are now under way and drawings are being made. It also includes completion by early next spring of 26 plants now under construction. Of a total of 126 plants now producing, or scheduled soon to produce this type of gasoline, 28 were under construction in June.

Though 71 of the proposed projects involve changes requiring an expenditure of less than $10,000 each, 46 come within the $10,000-$50,000 bracket; and 27 will cost approximately a million dollars each.

• • •

Power commission asserts its broadened jurisdiction

Asserting its broadened powers that came from a recent decision of the U. S. Supreme Court, the Federal Power Commission has ordered the Wisconsin Public Service Corp. to file by Oct. 1 an application for a license to reconstruct its hydro-electric plant on the Wisconsin River near Tomahawk, Wis. The company had filed a declaration of intention to reconstruct; the commission holds that it must apply for a license, which license carries with it the right of the federal government to take over the project at the end of the 50-yr. license period.

Wide World Photo

Eder reservoir completely emptied by R.A.F. attack

Clear evidence that Eder Dam was so deeply breached by the R.A.F. attack of last May as to completely drain the reservoir is shown in this air photo taken Aug. 17. Eder Dam and Moehne dams were attacked on May 16 (ENR May 20, p. 719 and June 17, p. 890) by Royal Air Force bombers who dropped mines behind the dams from their low-flying Lancasters.

Indications that repair work is under way is found in what observers state to be a narrow-gage railway crossing the river below the dam and leading up to the downstream face, also a construction camp near the railway below the dam.

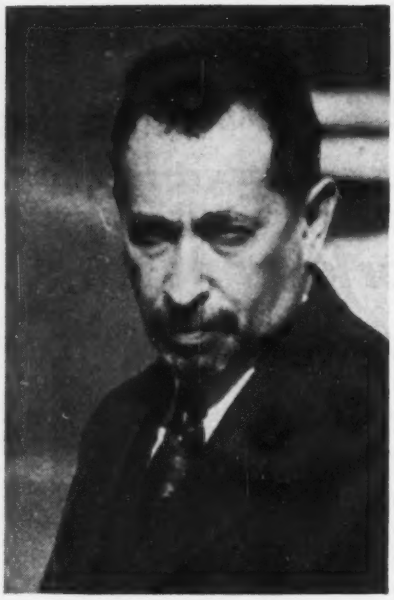
Leon S. Moisseiff dies; famous bridge engineer

Leon S. Moisseiff, widely known bridge engineer and a leader in structural engineering thought and development for the past half century, died of a heart attack on Sept. 3, at his summer home in Belmar, N. J. Mr. Moisseiff, who was 70 years old, lived in New York City, where he had maintained an office as a consulting engineer since 1915, before which, for 17 years, he had been progressively assistant engineer, chief draftsman and engineer of design in New York City's Department of Bridges. During those early days he was largely responsible for the design of the Queensborough cantilever and the Manhattan suspension bridges over the East River, as well as being in charge of the strengthening of the Williamsburg Bridge over the same waterway.

Starting with the Philadelphia-Camden Bridge in 1926, for which he was engineer of design, Mr. Moisseiff was a consultant on nearly every major suspension bridge in the country, including the George Washington, Triborough and Whitestone bridges at New York, the Maumee River bridge at Toledo, the Ambassador Bridge at Detroit, the Golden Gate and Bay bridges at San Francisco, the Narrows bridge at Tacoma and the proposed bridge across Mackinac Straits. He was also consultant on the great Kill Von Kull steel arch in New York, and it is interesting to recall that in 1907 Mr. Moisseiff was in charge of the design of W. H. Burr's proposed Henry Hudson Memorial Bridge, a reinforced concrete arch of 725-ft. span. At the time of his death he was actively engaged, in association with Holton D. Robinson, in preparing designs for the reconstruction of the Brooklyn Bridge at New York, a project which he had first worked upon in 1903 and again in 1906.

Born in Riga, Latvia (then Russia), Mr. Moisseiff came to the United States in 1891, after having attended technical schools in his native country. He received his civil engineering degree from Columbia University in 1895, and became a naturalized citizen in 1896.

Mr. Moisseiff's first job was with the New York Rapid Transit Railroad Commission, which he left in January, 1896, to become designing engineer for the Dutton Pneumatic Lock & Engineering Co., on drydocks, gates and lock improvements proposed for the Erie Canal. Then, after a short time as draftsman in the Bronx department of street improvements, he joined the Department of Bridges of New York City. Here, from 1898 until 1915, he worked his way up through various positions, until by 1900 he was chief draftsman on the computations and designs for the Manhattan and Queensborough bridges over the East River and



Leon S. Moisseiff

by 1903 was in entire charge of this work. During later years in the department, he had charge of the recomputation and reconstruction of the Williamsburg Bridge and was prominently identified with all of the other important bridge matters that were occupying New York City during that period of great bridge-building developments.

Mr. Moisseiff went to Russia in 1929 to serve for three years as consulting engineer to the Commissariat of Transportation. He was later a consultant on the great Palace of the Soviets, a structure not yet completed, but one which was planned to exceed the Empire State Building in height.

Always willing and anxious to utilize his energies and talents for the benefit of the structural engineering profession, Mr. Moisseiff was an active member and worker on committees of the American Society of Civil Engineers and the American Society for Testing Materials. In 1930, he accepted the chairmanship of the structural steel welding committee of the National Research Council, and did much to guide its activities up to the time of his death. As indicative of his broad interests, he also designed stainless railway cars, prepared a design handbook on structural aluminum, and did much productive research work on cold drawn bridge wire.

It is in the field of suspension bridges, however, that Mr. Moisseiff made his greatest contributions, and it is significant that he was connected with each of the four structures that are recognized as milestones during the past 35 years—the Manhattan, Philadelphia-Camden, George Washington and Tacoma Narrows bridges. As designer of the Manhattan Bridge he introduced the use of the deflection theory as a working tool; all suspension bridges since have benefited from the design procedures then used. As engineer of design on the Philadelphia-Camden Bridge, he was largely responsible for the use of two 30-in. dia. cables instead of four smaller ones, which would have followed then-current practice; by thus jumping cable size over 50 percent above any precedent he paved the way for the 36-in. cables of the George Washington Bridge, upon which he was consultant. Finally, he was consultant on the Tacoma Narrows Bridge, whose failure from aerodynamic instability brought this unsuspected and dangerous condition into such prominence that it should never again figure in a suspension bridge failure.

It was typical of Mr. Moisseiff that he was among the most active students of that failure, sparing neither his energy nor his reputation in supporting attempts to squeeze the last ounce of useful knowledge out of the disaster. At the time of his death he was chairman of the committee on interpretation and analysis appointed by the PRA, after the Tacoma failure, to investigate the entire range of fundamentals applying to long-span suspension bridge design.

• • •

Portland, Ore., engages New York planners

Robert Moses, commissioner of the Department of Parks of New York City has been engaged at a $100,000 fee to plan a postwar construction and development program for the Portland, Ore., area.

Drafting of the program, a 60-day undertaking, began Sept. 1. Of the $100,000 fee to Moses, $14,000 will go to his staff, $80,000 to eastern engineering firms and $6,000 to a firm of New York attorneys.

Many projects considered

Mr. Moses will consider development of an arterial highway system through the Portland district; unification and modernization of rail terminals, truck, bus and air transport facilities; and improvement of port and dock facilities including turning basins, drydocks, repair and wharfage accommodations.

Edgar J. Kaiser, son of Henry J. Kaiser, is a member of the Portland postwar committee, which laid much of the groundwork for the program.

Kaiser pointed out that at the end of the war 60,000 Kaiser shipyard workers would become unemployed making necessary an emergency program of useful construction projects.

As an example of the latter, Kaiser cited proposed aluminum bridge structures, which would utilize the region's newly developed aluminum industry.

ased on hydroelectric power developed Bonneville and Grand Coulee dams.

Engineers and lawyers

A staff of engineers and lawyers select- by Mr. Moses are working on the Port- nd survey, the expenses of which are eing borne by the City of Portland, ounty of Multnomah, Port of Portland, ortland Docks Commission and other fficial agencies. These experts have een closely associated with Mr. Moses his development of New York park- ays, bridges, parks and playgrounds, nd World's Fair plans.

Those on the staff

The staff includes W. Earle Andrews, onsulting engineer, who formerly was hief engineer of the city Parks Depart- ent under Commissioner Moses and ater chief engineer on plans for the orld's Fair; Gilmore D. Clarke, land- cape architect; J. J. Darcy, district ngineer of the New York State Public orks Department; Lewis L. Delafield r., lawyer; James F. Evans, director of ew York State parks; John C. Evans, hief engineer of the Port of New York uthority; Shortridge Hardesty, engineer ho built the Marine Parkway, Flushing iver, Cross Bay Boulevard.

Also, A. E. Howland, chief engineer of he Long Island State Park commission; ichard V. Hyland, consulting engineer ho has worked on most of Mr. Moses' arge projects in New York; Raymond P. cNulty, lawyer; Sidney Shapiro, deputy hief engineer of the Long Island State ark Commission; George E. Spargo, xecutive assistant to Mr. Moses in the ty Parks Department, and Harry Taylor, ssistant general manager of the Tri- orough Bridge Authority.

Termination of construction contracts covered by War Department regulation

Contractors allowed a profit on work done before the contract is terminated but are to be reimbursed for "mobilization cost."

The manner in which construction contracts of the War Department are to be terminated is outlined in Procurement Regulation No. 15, recently issued by the Army Service Forces as part of the federal government's announcement of policies with respect to termination of war contracts. The 80-page regulation includes special sections devoted to lump-sum and cost-plus-a-fixed-fee construction contracts.

In termination of lump-sum contracts, provision is made for settlement on the basis of all the work covered by the contract, regardless of the percentage of completion. This is true, even though the contract has been let on a unit-price basis. This provision is in contrast to that for supply contracts, which are settled on the basis of the uncompleted portion of the contracts.

In regard to profit, the construction contractor receives from the government not only the cost of actual construction but also a profit allowance calculated on the basis of the ratio of work done to the total contract.

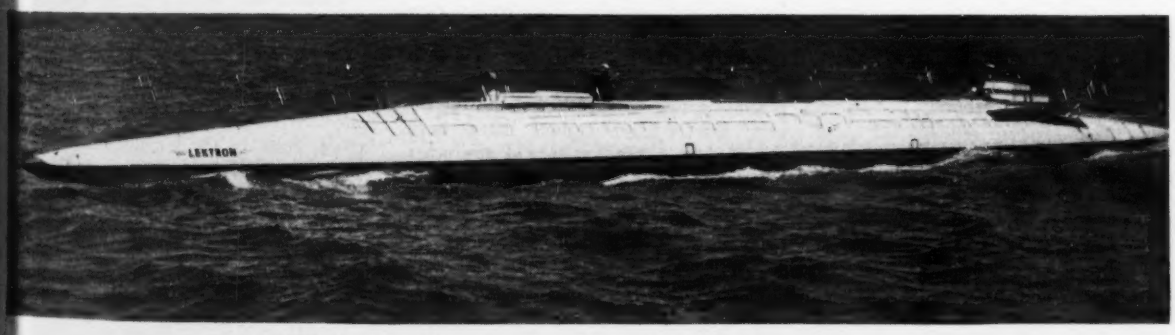
There is provision for spreading the "mobilization cost" or "starting-load cost" in construction work, "in accordance with recognized accounting practices, over the contract as a whole and allocated in part to the uncompleted portion of the contract."

In cases where conditions warrant suspending work without terminating the contract, provision is made for supplemental agreement, to be approved by the Chief of Engineers, "to compensate the contractor for all completed work plus an equitable amount representing the expense of demobilizing contractor's plant or organization." The government can later complete the work through another contractor or can abandon the project altogether. Wherever possible, in taking away one type of contract from a constructor, the government proposes to award him another for work still needed.

Contractors are instructed, where no termination article has been included in the contract, to insert one by means of a supplement. This can be done at the time of cessation of work.

The contractor is expected to cooperate with the War Manpower Commission in determining the workers to be released and in placing them elsewhere. Also, the regulation says, "Management should give the War Manpower Commission the names of such of its subcontractors and suppliers who, it is believed, will be substantially affected."

The same provisions which apply to cost-plus-a-fixed-fee construction contracts apply also to architect-engineer, and architect-engineer-manager contracts. No specific differences are listed in provisions for settlement, whether termination is due to some fault of the contractor or is for the convenience of the government, except that a different form is used.



A concrete ship of circular section is tried out in San Francisco Bay

Test runs have been made successfully on San ncisco Bay by a concrete ship 124 ft. long d of circular shape powered by two Ford engines which drove it through the water at speed of 19 knots, using only second gear. de with lightweight aggregate and consist- of a simple shell built around circular ribs h a maximum diameter of 7 ft., the model built and demonstrated before Navy and U. S. Maritime Commission officials in the endeavor to prove the feasibility of 10,000-ton freighters of this type whose dimensions would be 400x45 ft.

The model has ribs of 1½x4-in. section (the 4-in. dimension is radial), which are reinforced with hoops of ⅜-in. steel and have a maximum spacing of 54 in. The shell is 1½ in. thick, reinforced with ⅜-in. bars in both directions, ½ to 4 in. apart, wrapped with wire mesh.

Much more stability than can be had in a ship of usual design is claimed for a vessel of this shape.

On the test run, despite absence of load, the model rode steadily through choppy waves that caused accompanying tugs to pitch heavily. Hal B. Hayes, of Berkeley, Calif., is the inventor.

War housing construction is still one of the country's leading industries

Contracts totalling nearly two billion dollars for housing work have been entered into between the government and private contractors in two years. Housing news from various cities.

More than $360,000,000 in contract agreements with private construction companies for publicly-financed war housing projects were closed by the Federal Public Housing Authority in the first five months of 1943, FPHA Commissioner Herbert Emmerich announced recently.

These awards are part of a total of more than $1,808,285,000 representing 1,900 prime contracts for war housing entered into between the federal government and private contractors since July, 1940. The great majority of all publicly financed war housing authorized by the National Housing Agency is assigned to the FPHA for development.

Contracts during this emergency period have called for the construction of 607,843 dwellings, comprising family, dormitory and trailer accommodations for workers in war industry centers. Many hundreds of individual firms have received general contracts and the number of subcontractors participating in such essential construction work runs into the thousands.

Federal war housing contracts are let on a competitive basis to responsible private bidders. The growing interest of the private construction industry in federal war housing contracts is emphasized by the greatly increased number of bids received on projects put under contract during recent months.

Every contract award to a construction company means, in addition, a contract awarded to an architect-engineer, or, if the program warrants, separate contracts for architectural and engineering work. The construction of projects, moreover, involves the employment of large numbers of building trades workers and both skilled and unskilled laborers in related trades and services. During the first three months of 1943 alone, an average of 89,000 construction and salaried workers were employed on the site of FPHA war housing projects.

Milwaukee, Wis.—Frank Kirkpatrick, director of war housing center of the National Housing Agency, has recommended that 780 new housing units be constructed in Milwaukee to accommodate in-migrant war workers and their families. All of the housing is to be constructed by private builders.

Johnsville, Pa.—A city of 1,200 homes is being speedily erected here as a governmental war housing project for workers at Brewster Aeronautical Corporation's Johnsville division.

The project will be complete in every detail. Units will be for from two to six families and will be of one and two-story construction. They will be modern in every way and will be heated by coal.

There will be a special water pumping station erected to supply the project. The large sewage disposal plant which serves Brewster Aeronautical Corporation will be doubled to accommodate the new development. There will be a new school erected in Warminster Township to accommodate 600 pupils. Community stores and complete recreational facilities also are included in the project. A feature will be two day nurseries where war workers may leave children during employment hours.

Lieutenant John Kendall, USNR, of the office of the Senior Naval Advisor, Philadelphia, was responsible for co-ordinating the various government agencies on this project.

New Orleans, La.—The War Production Board has approved construction of 111 new dwelling units in New Orleans.

Dallas, Tex.—Construction probably will get under way in September on some of the 2,296 homes recently authorized for private construction in Dallas. R. E. Shepherd, regional manager of the Federal Housing Administration, said recently.

Dallas contractors have gotten so enthusiastically behind the program to relieve the acute housing shortage that they have filed applications for priorities to build 700 more than the 2,296 units approved July 15, Shepherd said. Applications now are closed, but the 700 excess priority applications have been accepted as a backlog should any other applicants fail to build, he said.

Florida—A program providing 1,254 additional war housing accommodations for incoming workers in essential war industries in Panama City has been approved by the National Housing Agency, NHA Regional Representative Robert K. Creighton announced at Jacksonville Aug. 9.

With the addition of the new program and with completion of projects now under construction or scheduled for early starting, a total of 5,574 war housing accommodations will have been built in Panama City under the NHA program. These units will house approximately 15,000 persons, in addition to many hundreds of war workers who have found quarters in existing houses.

A program providing 770 additional war housing accommodations for workers in essential industries in Tampa has been approved by the National Housing Agency. The new program calls for the construction of 620 publicly-financed family units for negroes, including 500 to be built of permanent construction in Tampa itself, and 120 units to be of temporary construction located at Port Tampa city.

In addition, 150 family units will be provided by privately-financed conversions of existing buildings in Tampa and its immediate environs.

Portland, Ore.—The last of 9,942 dwelling units at Vanport City—the defense housing project for the Portland area—has been completed.

Two Portland firms, George H. Buckler company and Wegman & Sons, are winding up nine months work under the Federal Public Housing administration. The general contract originally was held by the Kaiser company, shipbuilders, until the FPHA took the project over from the Maritime Commission.

Management and operation of the dwellings will be under charge of the Portland Housing authority.

Muscle Shoals, Ala.—Hardin & Ramsay, Atlanta, Ga., have been awarded a contract for the construction of 200 family dwellings and community facilities for war workers at Muscle Shoals, on a bid of $397,800. The completion date is set for ninety days from Aug. 24. The award was made by J. P. Broom, Regional Director, Federal Public Housing Authority.

Washington, D. C.—In the Washington, metropolitan area, the National Housing Agency has approved a program calling for 3,200 additional family dwelling units for Negro war workers. It has cancelled plans for an additional 1,207 family units to the Fairlington project of the Defense Homes Corp. in Arlington, Va., and for two additional dormitory projects for 3,433 single persons, as the supply of war housing for white occupancy is ample.

Completion of the units recently authorized will bring the war housing program for the area to 46,000 family units and over 10,000 dormitory accommodations. This is exclusive of approximately 32,000 family units built by private constructors after the spring of 1940 but before priorities assistance became necessary.

It is expected that the housing need for white families and individuals in Washington can be met with existing structures and those definitely scheduled.

Engineering and construction news from Mexico

Construction of the Teguixquiac Tunnel for flood-control in the Mexico City ... continues on a seven-day, 24-hr. ...dule. One of the largest construction ...now under way in the vicinity of ...o City, the $5,750,000 project is ...iles long. The tunnel is being driven ...extreme northern end of the Valley ...exico near the Zumpango Lagoon. ...bore, which is through much diffi... ground, will be lined with 30 in. of ...rced concrete and below the lining ...n. drain will be laid. The intake ...ter will be 18 ft. The job is di... by Armando-Santa Cruz, chief of ...ulics department of the Ministry of ...unications and Public Works. Com... of the work in 1945 is expected.

...new highway from El Paso, Tex., ...xico City will be passable in the ...near future and will be paved within ...nths, Gen. Maximino Avila Cam..., Mexican communications secretary, ...nounced. General Camancho, who ... all road building, said a large ... of an additional federal road ap...iation of $7,500,000 would be ex...d on the El Paso road this year. ...oute connects at the border with ... Highway 85, which serves Albu...que, N. M., Denver, Colo., and ...nne, Wyo.

...ans for a bridge over the Tiajuana ... to connect Tiajuana, Lower Cali... Territory, with the United States, ...been approved by the Ministry of ...unications and Public Works. ... estimates that the job will cost ...00. The ministry will provide ... one-fourth and Tiajuana the bal... The work is scheduled to start ... Oct. 1.

...ico is intensifying her road build... and overhauling program this year ...an investment of $5,500,000, the ...ds of the marketing of 1943 high... ...nds of the United Mexican States.

...ans for the construction of a build... ...the port of Vera Cruz to house ...naval offices and a naval academy ...Gulf Zone have been approved ... Marine Ministry. The building ...ost $735,000. The school will ac...date 350 cadets. Work on the ...g is to start soon.

...Mexican government is to provide ...00 in 1944 for the construction ...am at Nejapa, Oaxaca state, that ...irrigate 148,000 acres in the Isthmus ...Tehuantepec for fruit and other crops, ...Vicente Gonzalez, governor of Oax..., announced after a conference with ...President in Mexico City. Work on the dam is to start in January, as soon as the first money of the appropriation is forthcoming, Governor Gonzalez said.

The municipal government of Cuernavaca, capitol of Morelos state, has obtained a loan of $225,000 from the National Urban Mortgage and Public Works Bank, a federal institution of Mexico City, to improve and expand its waterworks system. The loan is to be paid in monthly installments over six years. Cuernavaca is a popular American tourist resort.

At least three years longer will be necessary to complete the rehabilitation of the National Railways of Mexico, according to Oliver M. Stevens, chief of the committee of American rail experts who is supervising the undertaking. Mr. Stevens has arranged for more American railway men to go to Mexico soon to participate in the rehabilitation program. They are experts in engineering, rail transportation and accounting. Stevens declared that the railways' trunk line between Mexico City and Laredo, Tex., has been greatly improved due to the conditioning the railroad performed at the commission's suggestion.

Studies for the establishment of a new railroad terminal at Torreon, Coahuila state, capital of the Laguna district, Mexico's most important cotton zone, are being made by a commission appointed by President Manuel Avila Camacho. The committee consists of A. Santacruz, civil engineer of the Ministry of Communications and Public Works; Jose Maria Rodriquez of the Public Health Department; Luis Prieto Souza, architect of the Ministry of Finance, and J. Maria Rodriguez Vidaurri, construction engineer of the National Railways of Mexico.

Plans call for a large passenger and freight depot, warehouse, machinery shelters, a round-house and shops for repairing locomotives, cars and coaches. Costs of the undertaking are estimated at about 10 million pesos ($2,250,000). The commission was expected to report to the President about Sept. 1.

Aid from the Office of the Coordinator of Inter-American Affairs and the Direction of the Inter-American Cooperative Health Service will enable Mexico to provide 71 communities in 20 states along the Mexican section of the Inter-American Highway with water supplies and sanitation services, according to Victor Fernandez Manero, chief of the Mexican Public Health Department. Total cost of the work will be $2,750,000.

Execution of the undertaking, Manero explained, will be in accordance with plans for the advancement of sanitation in the American countries adopted at the Rio de Janeiro convention in January, 1942. The investment and performance of the work will be directed by the service and the department. The service is represented in Mexico by a committee composed of E. Harold Hinman, chairman, Capt. W. Martin Johnson, sanitation engineer, Charles T. Pilot and C. H. Hirst. The general supervisor of the undertaking is Gen. George C. Dunham, of the Coordinator's Office, who has visited Mexico twice in connection with the project.

Mexico's contribution, Manero reports, will be with funds his department has available and the provision of technical elements, particularly sanitation engineers. The Mexican department has already prepared most of the plans and specifications for the job and is closely collaborating with the service in the furtherance of the undertaking. Manero indicated that the work is to start in the near future.

. . .

ODT aids essential truck operators to get tires

Eligible truck operators who hold tire rationing certificates but who are unable to obtain within their county the proper tires may apply to their nearest Motor Transport District Office of the Office of Defense Transportation for assistance, the ODT announced Aug. 24. This information will in turn be transmitted daily to the Office of the Rubber Director which will endeavor to arrange for the proper redistribution of tires so that all the certificates can be honored as quickly as possible.

This procedure was decided upon, the ODT stated, after some truck operators reported they were unable to obtain critically needed tires and as a result had to keep vehicles out of operation. In some cases it was reported important war freight was delayed for this reason.

Why Copies Are Late

If this and other copies of *Engineering News-Record* have failed to reach you at the accustomed time, it has not been the fault of the publisher. Mail and transportation services are operating under great difficulties because of war conditions, and this is causing delays in delivery.

JOBS OF THE WEEK

IMPROVEMENTS, Canal Zone
Bureau Yards & Docks, Navy Dept., Washington, D. C., awarded the contract for improvements, to Williams Bros. Corp., Tulsa, Okla.

PARKING AREAS, New York
Andrew Weston Co., Inc., Woodmere, N. Y., has been awarded the contract for parking areas in Nassau County by U. S. Engineers, New York, N. Y. The estimated cost is $700,000.

ROAD, Arizona
Basich Brothers, Alhambra, Calif., was the lowest bidder for roads in Coconino County, when U. S. Engineers, Los Angeles, Calif., opened bids. The estimated cost is from $600,000 to $700,000.

DWELLINGS, Inglewood, Calif.
Sunset Operating Co., Bellflower, will construct by own forces three hundred seventy-four dwellings, to cost more than $1,000,000. Matcham & Heltschmidr, Los Angeles, are the architects.

HOUSING, Clearfield, Utah
Public Housing Authority, Kansas City, Mo., awarded a contract for the construction of dwellings to Robert E. McKee, Los Angeles, Calif. The estimated cost is $957,000. Ashton, Evans & Hodgson, Salt Lake City, are architects.

DWELLINGS, California
Lee Epp, San Francisco, Calif., has been awarded the contract to build 1,000 family dwellings and an administration building, by Housing Authority of Contra Costa County, Martinez, Calif., $1,696,361. E. Geoffrey Bangs, Keith O. Narbett, and Eldridge T. Spencer, San Francisco, Calif., are architects.

MANUFACTURING PLANT, Maryland
Revere Copper and Brass, Inc., New York, N. Y., will construct a manufacturing plant to cost $6,000,000. Defense Plant Corp. will finance. James Stewart & Co., New York, N. Y., has been awarded the contract.

HOUSES, Spokane, Wash.
Waale-Camplan Co., Portland, Ore., will construct houses for Carroll, Hillman & Hedlund, Seattle, Wash., at a cost of $3,300,000. Stuart & Durham, Seattle, Wash., are the architects.

ROADS, Texas
U. S. Engineers, Denison, awarded the contract for asphalt and concrete paving in Dallas County, to Texas Bithulitic Co., Dallas, at $742,000.

BUILDINGS, Illinois
U. S. Engineers, Chicago, awarded the contract for building to J. W. Snyder Co., Chicago, at $437,900; 2nd section of building, to Paschen Bros., Chicago. The cost is over $1,000,000. Both Cook County.

HYDROGENATION UNIT, Texas
Humble Oil & Refining Co., Houston and Baytown, Tex., has awarded the contract for the construction of a hydrogenation unit at a gasoline refinery plant to Stone & Webster Eng. Corp., Boston, Mass., and Baytown, Tex. The cost is $2,000,000. Federally financed.

RESERVOIR, Mexico, Mexico City
Ministry of Communications & Public Works, Mexico City, c/o E. Suarez, Secretary of Finance, will construct a reservoir, or reservoirs, etc., for flood prevention, force account. The cost is approximately $2,500,000.

HOUSING, Bainbridge, Md.
Bureau Yards & Docks, Navy Dept., Washington, D. C., awarded the contract for additional housing at Naval Training Station, to John McShain, Inc., Phila., Pa., at $1,987,200. Eggers & Higgins, New York, N. Y., are the architects.

HOUSING, Nebraska
Public Housing Authority, Kansas City, Mo., awarded a contract for housing, to Francis R. Orshek Co., Amarillo, Tex. The proposal is $3,637,766. Kimball, Steele, Sandham & Steinbaugh, Omaha, Neb., are the architects and engineers.

CONSTRUCTION, Washington
U. S. Engineers, Seattle, Zone 4, awarded the contract for construction at military installation, King County, to Sound Construction, Ford J. Twaits and Morrison-Knudsen Co., Inc., all of Seattle, Wash. The estimated cost is over $1,000,000.

Note—Additional bidding and contract news on many projects large and small appear in the Construction News section beginning on page 76.

An air-borne tractor shovel

Air-borne tractor shovels are proving a valuable asset to the war effort on beaches and fighting fronts. This air-borne shovel is small, rugged and compact, and can be stowed away easily on a glider or transport plane from which it emerges ready for action. While much war material is being shipped via air to a score of battle fronts, it is significant that this piece of earth moving equipment was especially designed by the Frank G. Hough Co. for air transportation. Such shovels are used for road construction, building gun emplacements and tank traps, and excavating for camp sites, etc.

Another war-time application of Hough equipment is the use of tractor-powered brooms of various sizes in maintaining airports and landing strips.

Florida seeks to acquire bridge over Tampa Bay

The State Road Department of Florida seeks to acquire for the state the Gandy bridge and the Davis causeway across Tampa Bay.

It is set forth that Al Gandy, principal stockholder and president of the Gandy Bridge company, has declined to offer the span for sale.

Governor Holland has informed federal officials that litigation by the state to acquire Gandy bridge by condemnation might require years, and has asked that condemnation proceedings be brought by the federal government under its war powers.

As for the Davis causeway, the department said in a resolution that owners have agreed to sell at an acceptable price. Members said the figure set is $1,175,000.

The resolution asked the Federal Works administrator to approve purchase of the causeway, and to appropriate from federal road funds allocated to the state of Florida enough money to pay one-half of the cost. The department said it would operate the causeway as a free bridge.

OBITUARY

W. F. Bennett, 68, consulting engi- who had supervised important con- tion in this country and England, in New York City, Aug. 31. Mr. ett was a graduate of the University ichigan, 1899, when he received his e of bachelor of science in civil neering. While with the Thompson- ett Co., 1901-04, he supervised the ing of the St. Regis and Algonquin ls in New York and the Philadelphia building and factory for Bailey, s & Biddle. He later did important truction work in London, England. 1910 to 1914 while Deputy and g Commissioner of the Department ater Supply, Gas and Electricity of City of New York, Mr. Bennett ad- the department on engineering ers which involved an expenditure 0,000,000 a year. During the next years he was consulting engineer to president of the Borough of the x.

rd Taylor McKnew, 56, a technical neer with the Federal Housing Ad- tration, Washington, D. C., died 27. A graduate of Cornell Uni- ty, he had been in the building business before joining FHA four ago.

ett J. Kane, 44, until recently tor of operations and chief engineer e WPA in Ohio, died in Columbus ug. 26. Graduated from Ohio State ersity in civil engineering in 1924, Kane was grade separation engineer e state highway department before ning associated with the WPA.

E. Born, 75, died at Pittsburgh, ug. 29. He had been general man- ager of Jones & Brown Corp., and had been engaged in home construction for 50 years. At one time he supervised an industrial housing project of 2,000 homes.

Joseph G. Kuhn, executive vice president of the Arundel Corp., and a leading hydraulic and dredging engineer, died at Baltimore, Md., Aug. 31.

Paul J. Buerkle, 78, of Stuttgart, Ark., contractor and builder, died at Little Rock, Aug. 23. He was the son of the founder of the townsite of Stuttgart and was contractor for most of the town's early stores, residences and public buildings.

News of the Week
Continued on p. 132

CONTRACTS AND CAPITAL

CIVIL ENGINEERING construction volume in continental U. S. for the holiday-shortened week totals $36,606,000. This volume, not including construction by military combat engineers, American contracts outside the country, and shipbuilding, is 62 percent below the corresponding 1942 week's total, and compares with $61,674,000 reported for the preceding week. Private construction is 58 percent lower than a year ago, and public work is down 63 percent as a result of the 61 percent decline in state and municipal construction and the 63 percent decrease in federal volume.

The current week's construction brings 1943 volume to $2,322,368,000, an average of $64,510,000 for each of the 36 weeks of the period. On the weekly average basis, 1943 construction is 67 percent lower than the $7,278,879,000 for the 37-week period in 1942. Private construction, $296,735,000, is 33 percent below last year, and public construction, $2,025,633,000, is down 69 percent when adjusted for the difference in the number of weeks.

In the classified construction groups, gains over last week are in waterworks, sewerage, and commercial buildings. The latter is the only class to gain over the 1942 week.

New capital for construction purposes for the week total $177,000, and is made up entirely of state and municipal bond sales. New construction financing for the 36 weeks of 1943, $2,929,155,000, is 68 percent below the $9,524,957,000 reported for the 37-week 1942 period.

CONTRACTS

Continental U. S. Only (Thousands of dollars)

	Week Ending Sept. 10 1942	Sept. 2 1943	Sept. 9 1943
Federal	$75,522	$51,144	$27,641
State & Municipal	5,869	3,776	2,266
Total public	$81,391	$54,920	$29,907
Total private	15,920	6,754	6,699
TOTAL	$97,311	$61,674	$36,606
Cumulative 1943 (36 weeks)			$2,322,368
1942 (37 weeks)			$7,278,879

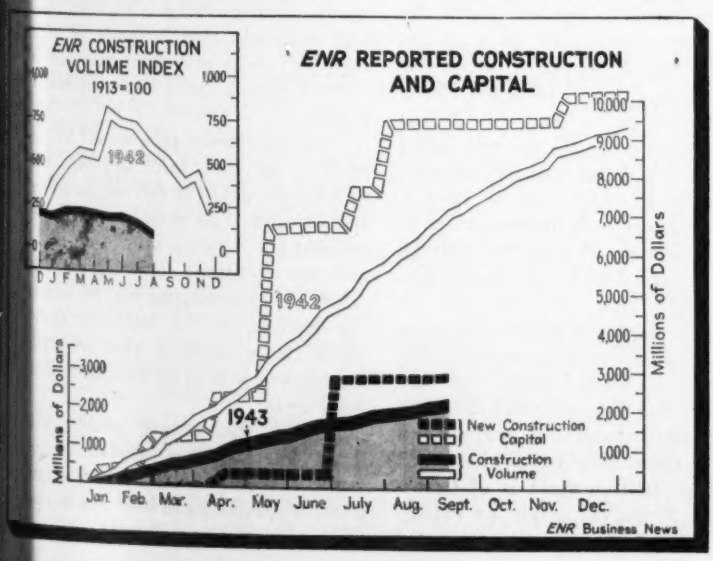
Note: Minimum size projects included are: Waterworks and waterways projects, $15,000; other public works, $25,000; industrial buildings, $40,000; other buildings, $150,000.

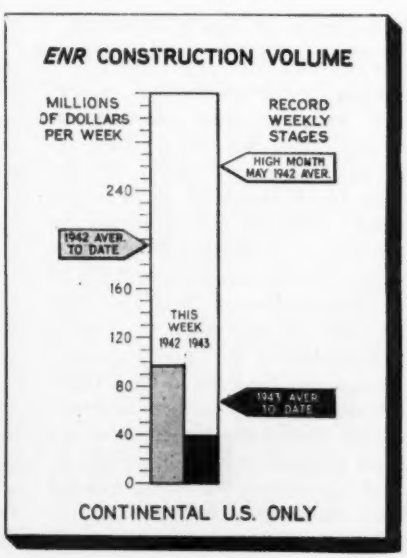
NEW PRODUCTIVE CAPITAL

	Cumulative 1942 37 weeks	1943 36 weeks
NON-FEDERAL	$558,059	$275,317
Corp. Securities	169,324	17,408
State & Mun.	177,580	97,776
R.F.C. loans	128,455	9,000
FPHA loans	.....	3,133
R.E.A. loans	.....	20,000
Fed.-Aid Hwy.	82,700	128,000
FEDERAL	$8,966,898	$2,653,838
TOTAL CAPITAL	$9,524,957	$2,929,155

ENR INDEX NUMBERS

		1913	1926
Index Base=100			
Construction Cost	Sept. '43	294.09	141.37
Building Cost	Sept. '43	231.20	124.98
Volume	Aug. '43	119	52


ENR CONSTRUCTION VOLUME INDEX
1913=100
1942
D J F M A M J J A S O N D
ENR REPORTED CONSTRUCTION AND CAPITAL
1942
1943
New Construction Capital
Construction Volume
Millions of Dollars
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.
ENR Business News



Comment and Discussion

Readers' opinions on matters that concern engineers and contractors

Bridge Stiffening Trusses

Sir: In your issue for Aug. 26, p. 317, I note a letter from Homer M. Hadley referring to mine in July 15 issue commenting upon the Tacoma Narrows Bridge.

As Mr. Hadley correctly points out, the George Washington Bridge as at present constructed has no stiffening truss whatever. It has, however, four cables 36 in. in diameter and the excessive dead load of these cables provides such high resistance to local distortion as to permit no serious deflection at any point from the action of a maximum concentrated live load. This resistance to distortion is also a safeguard against objectionable behavior under high winds.

In this respect the George Washington Bridge is in a class by itself. The writer knows of no other suspension bridge in which such construction has been permissible. For a bridge of more usual proportions a stiffening girder is always required to limit local vertical deflection from live load, and it is to such structures that the writer's former remarks were intended to apply.

FRANCIS P. WITMER
Cynwyd, Pa.

Waterways in South America

Dear Sir: In view of Fred Lavis' sweeping condemnation of waterways running north and south through South America (*ENR* Aug. 12, p. 277) as proposed by the writer (*ENR* March 11, p. 30), it is believed that the writer should be permitted to set forth the following:

The criticism mentions the Falls of the Iguassu, those of the Upper Parana, the Madeira-Mamore rapids, the high stage of the Upper Parana at Posadas, and the Falls of the Caroni, in Venezuela. None of these have any bearing (except the Madeira-Mamore rapids which have been taken into account by entering the Mamore above them) on the route indicated.

Nothing is further from the writer's mind than a desire to present a "grandiose scheme" or to imply that here is "a God given channel of commerce." The basic thought is that, just as the auto-truck is a factor in transport economy in many places, so the power-driven boat of small tonnage could be an important factor in this case. Citing the Mississippi and the N. Y. State Barge Canal is beside the point. These have adverse factors, not the least being winter conditions and unpredictable and erratic floods, on the river. In the case under examination the "floods" come at known seasons, annually, and the high and low stages of the rivers do not vary much from year to year. On the Amazon rivers navigators do not worry much about high or low water.

Why connect the Guapore and the Paraguay? Because Corumba is the river terminus of the North West Railway of Brasil and the growing industries of Sao Paulo could find much use for the various things extracted from the territory contiguous to the Purus and the Madeira-Mamore. Likewise certain Brasilian manufactures would go back to Amazonas by this route. Furthermore the recent reciprocal treaties between Brasil and Argentina are causing a greater exchange of goods between these countries.

Even Brasilian rubber, which the writer considers dead as a prime foreign export, except for the moment, is in demand in South Brasil and Argentina.

Concerning the 90 percent infant death rate in Amazonia, this estimate is a trifle liberal; even in 1910 it never attained such figures except in the imagination of transient visitors, and the work done by the Rockefeller Foundation and the D.S.N.P. of Brasil has improved health and living conditions to a marked degree in the last two decades. Likewise we are aware of the "legend" that the territory is fitted mainly for negroes and oriental races. However the backbone of the population there is of Cearaense or Portugese origin or extraction. Both of these people are noted for their stamina and the ability to carry on by those who have been intimately associated with them. In 1910 Manaos had 50,000 population, today 90,000.

To sum up, the scheme presented was not intended to be spectacular nor to solve the integrated problem of South American transport at a stroke. Its intent was merely to paint a picture of something that might play a part in the whole scene. It was intended to point the way to a "pilot" route, worthy of study and "in situ" investigation by those who had the command of means to make the investigation. To point out a route adapted, for the immediate present, to river traffic carried out by means comparable to auto-truck traffic carried out on highways.

CHARLES JAY SEIBERT,
Washington, D. C.

Staggered Rail Joints

Sir: In your May 20 issue, p. 727, W. J. Burton commented upon my letter which you printed on March 25. The discussion concerns the staggering of rail joints in railroad track. I claim that the placing of each rail joint exactly opposite the center of rail on the other side of track greatly increases the objectionable side sway of cars. And I still am of the opinion that rails are laid in this manner as a result of habitually following a faulty practice.

Mr. Burton states that the "opposite" or "square" joints produce a vertical leaping motion of cars when the train is moving at some critical speed. This is entirely logical. But why eliminate this tendency by substituting a side sway that possibly is worse? Maybe there is a still better scheme.

Perhaps a better plan would be the locating of each joint opposite the quarter point of the rail on the other side of track. This arrangement might prevent the building up of objectionable car vibrations. It would seem to offer less encouragement to either the leaping or the bobbing about which cause so much wear on track and cars as well as on the patience of passengers.

Possibly the railroad industry will some day produce a satisfactory rail joint. There have been many attempts to do this, but we still have low joints. Evidence of these attempts is pre-

sented by the number of new types of splice bars that appear from time to time and then are abandoned in favor of something still newer but perhaps not any better. A really satisfactory type of splice bar would give passengers a smoother ride for their money and would save a vast amount of money for the railroads.

LEONARD C. JORDAN
New Rochelle, N. Y.

Shortcuts for Engineers

Sir: Referring to my article "Mathematical Shortcuts for Engineers" in your issue of May 20, p. 747, I have received a number of inquiries as to the sources from which my list of formulas was compiled. One prominent engineer remarked that he had been making a similar lifelong collection. In order to correct an apparent erroneous impression, and to emphasize the ease of formulating such empirical relations, permit me to state that all of the formulas in that article are original and believed to be new; all of them were recently derived, as a spare-time recreation, within the space of a month.

The article was submitted for publication in the hope that it would elicit similar contributions from others.

D. B. STEINMAN,
Consulting Engineer,
New York, N. Y.

Ehlers' Design Tables

Dear Sir: In a reply to a comment of Prof. Tschebotarioff, concerning priority of methods for designing reinforced concrete sections subjected to normal forces and bending (*ENR*, July 29, 1943, p. 187), Prof. Odd Albert makes some statements which cannot be considered as correct.

Speaking of "Ehlers' Table," frequently used in Europe, Prof. Albert states that this table deals with columns only and that it is based upon assumptions that are only approximately correct.

Ehlers' table can, of course, be used for beams as well as for columns, provided the section is rectangular. For all formulas which underlie the computations apply to any eccentrically loaded section, without regard whether this section belongs to a column or to a beam.

As to the point that Ehlers' table is based on approximate assumptions only, it seems to the writer that Prof. Albert has somewhat misunderstood the meaning of the table and the purpose it is intended to serve.

It has always to be kept in mind that the normal stresses of any section are related to the exterior forces by only two conditions of equilibrium (the third referring to the shear stresses) and that, therefore, only two unknowns can be found, whatever the problem in question may be. All other values must be given or assumed.

The problem for which Ehlers worked out his table was to compute the two unknowns A_s and A'_s from *the given values* M, N, b, d, f_c and f_s, but not to find, at the same time, the depth d, which, according to the previous statement, is obviously impossible. Therefore the relation

$$d = \alpha \sqrt{\frac{M_e}{b}}$$

is not supposed to be used to find the depth d, but to compute

$$\alpha = \frac{d}{\sqrt{\frac{M_e}{b}}}$$

This is the value with which to enter the table and which, together with the assumed stresses f_c and f_s, finally leads to the corresponding reinforcements A_s and A'_s. In this way Ehlers' table is mathematically absolutely correct.

The writer takes the opportunity to mention that the basic idea of using the moment about the centerline of the tensile (or compressive) reinforcement is even older than Ehlers. Before him Wuczowsky (1911), Jaray, and Mayer based their methods on the same principle. Also Moersch used both moments M_e and M'_e to plot his diagrams, from which not only the percentage of tensile and compressive reinforcements can be directly found, but which, at a glance and without further computation, show the minimum total reinforcement. Unfortunately these very interesting charts of Moersch (which are based on $n = 15$, but which could be easily redrawn to fit any value of n) cannot be used in this country, because, at least for eccentrically loaded columns, the A.C.I. code makes the allowable concrete stress a function of the relative eccentricity and of the percentage of reinforcement. For the mostly used (although not most economical) case of symmetrical reinforcement, the structural department of the company with which the writer is working, has drawn, for its own use, some charts that take into consideration the variation of f_c and from which the total symmetrical reinforcement can be read very easily.

ROBERT V. HAUER,
Structural Engineer,
Detroit, Mich.

Sir: The writer fully agrees with the above comments by Mr. Robert V. Hauer concerning statements made by Odd Albert but believes that they should be amplified by the following:

(1). The assumptions on which the Ehler's Table is based are not approximate in the sense that they are mathematically rigorous and identical to the ones on which all reinforced concrete design formulas are based including the ones presented by Mr. Albert. This can be checked by the fact that the results obtained by the formulas presented by Mr. Albert are identical with the ones obtained by the use of the Ehler's Table.

(2). An Ehler's type table can also be conveniently used to find the depth d, by first assuming a desired percentage of compressive reinforcement p'. Then the only two remaining unknowns are d and A_s which can be found from the coefficients α and p interrelated by the Ehler's Table to p'.

GREGORY P. TSCHEBOTARIOFF,
Associate Professor of Civil Engineering
Princeton University
Princeton, New Jersey

What Engineers Say

"It will take $50,000,000 and three or four years work to put North Carolina's highways back into the same shape they were before Pearl Harbor."—W. VANCE BAISE, *chief engineer, North Carolina State Highway Department.*

"It doesn't take much imagination to foresee what the effect would be of the instant cancellation of the $50,000,000,000 to $60,000,000,000 government contracts which will be outstanding when the war ends. It has been suggested that this time we might taper off gradually by permitting at least some of the war goods producers to continue work on their contracts for some months, especially on goods for which civilian uses can be found."—MAJ. GENERAL PHILIP B. FLEMING, *Administrator, Federal Works Agency.*

EDITORIALS

VOLUME 131 NUMBER 11

September 9, 1943

A Great Engineer

LEON MOISSEIFF was a man of a thousand triumphs and one failure, and it is the irony of fate that death should have cheated him of the opportunity to fashion yet other achievements of which he was well capable. By his death the profession of structural engineering lost one of its most notable practitioners and effective leaders. There are few great bridges in this country or Canada that have not benefited from the exercise of his outstanding talents for analysis and design; and many engineers have breathed easier after their designs carried the stamp of Mr. Moisseiff's approval. As an engineer whose advice was often sought by other engineers, he occupied an enviable position. Never satisfied with the state of the structural engineering art, Mr. Moisseiff was always striving to improve it—not by faltering and easy steps, but boldly. Two results of his pioneering spirit and his keen and penetrating mind were the development of the deflection theory of suspension bridge design into a practical working tool and the Tacoma Narrows Bridge; one an outstanding success, the other a disastrous failure. Paradoxically, and despite the fact that every major suspension bridge in the country has benefited from the existence of the deflection theory procedure, it may be that the lessons learned from the Tacoma failure will advance the structural art most. For Mr. Moisseiff, by boldly pushing forward along a road that others were following more slowly, exposed the dangers in time for others to avoid them. Although dearly bought, that, too, approaches being a success, and history may so record it. In the meantime, Mr. Moisseiff's high place among the great structural engineers of all time is assured. His contributions to knowledge in the fields of alloy steels, structural aluminum and welding constitute a legacy of high value. And it should not be forgotten that it was he, as engineer of design of the Philadelphia-Camden Bridge, who first pushed the size of suspension bridge cables far beyond the proportions set by Roebling a half century before on the Brooklyn Bridge. The engineering profession and the nation at large are immensely richer by virtue of Leon Moisseiff's efforts and accomplishments.

Foundations on Compacted Fill

STUDY OF THE SITE for a Midwest ordnance pla showed that foundation piers of the normal ty would have to be sunk quite deep at some poin and that floors might settle, causing misalignme of conveyors unless made selfsupporting. As suc a foundation system would have been costly an would have involved the use of considerable rei forcing steel, practices common to highway wor but unusual in building construction were adopte Soft spots over the site were dug out and refille with soil compacted to optimum density, and lo points were filled by similar methods. As a resul column footings could be made shallow and floo could be laid directly on the surface with assu ance that no settlement would occur. Large saving in steel, concrete and form lumber were mad Thus, soil compaction methods, developed first i earth dams and later applied to highway constru tion, are shown to be applicable under some co ditions to building work. Future designers o large factories on sites calling for deep and elab rate footings may well study the possibilities o remaking the site to reduce their foundation costs.

Uniform Highway Limitations

FOR MANY YEARS prior to Pearl Harbor state law restricted the size of trucks and the weight the could carry on highway systems throughout th country. That these regulations were not unifor caused considerable confusion in the highway trans portation industry. A driver might start from hom with his truck loaded within the legal limit, only t find himself in trouble as soon as he crossed the lin into a state where truck length, gross weight, axi load, and license regulations differed. With th coming of war, these limitations were large eliminated through executive orders of state gove nors or by legislative action. In some instances th load restrictions were liberalized for the durati of the war, while in others they were permanentl relaxed—all for the primary purpose of speedin the shipment of war materials. Standardized leg limits for truck operation, both as to size an weight, should be an important consideration i postwar highway planning programs. Since pra tically all main highways and bridges are design to meet standards set by the American Associatio of State Highway Officials, state statutes for th control of truck movements should be in the close possible agreements with the A.A.S.H.O. specifica tions as to loading. If experience during the wa shows that nation-wide use of the H-15 loading causing the breakdown of old pavements in so

regions due to lack of adequate maintenance during the war periods, then the A.A.S.H.O. might well take early action looking toward establishment of regional restrictions that could be applied temporarily until the maintenance and replacement program catches up with current needs. But restoration of punitive restrictions having no relation to the roadway structure should be resisted following the war.

Relief of Welding Stresses

STRUCTURAL ENGINEERS of tomorrow will be expected to know how to lay out welded sequences so as to avoid or to balance locked-up stresses in steel structures. This appears to be inevitable in view of the current trend toward wider use of welding in construction. Today, in the nation's shipyards, many civil engineers are acquiring knowledge that will prove to be an asset to them and to structural engineering generally in the postwar period. Hence the significance of the article on shipbuilders' technique for release of welding stresses on p. 409 in this issue and of another that is to follow. What men in the shipyards are learning about distortion due to welding heat and about residual stresses must be part of the equipment of the engineers who design and build welded structures after the war if they are to hold their place in the structural engineering field. No one yet knows all the answers, but if structural engineers will study carefully the shipyard experience, many unknowns of yesterday will be eliminated, and welding as a tool of construction will move forward to a new place of importance in the period following the war.

National Planning Needed

THE NATION lost its only national planning agency when Congress, impatient with visionary planning, refused to provide funds for continuation of the National Resources Board and specifically instructed the President not to transfer the board's functions to any other federal agency. All of which probably did not mean that Congress found nothing good in what the board and its predecessors had done over the past several years. What it did mean was that Congress was thoroughly fed up with the practice of New Deal theorists of by-passing Congress in attempting to get their ideas of social reforms put into effect. The Resources Board, which permitted its voluminous publications to be used for expounding many of those theories, was made the scapegoat.

But though the board can be charged with mistakes, it must also be credited with accomplishments. Inauguration of a plan for six-year advance programming of federal construction work was one of them, as was the stimulation of advance public-works planning by state and local agencies. Also, the board assembled and correlated a large amount of useful data relating to natural resources, and made valuable contributions to plans for development of our river systems. That its practical contributions were not more generally acknowledged was due largely to the fact that the were obscured by social reform schemes when they were presented to the public.

A recent report on "The Future of Transportation" is a good example. Some very pertinent comment on physical defects of our present system of transportation were completely lost to public attention because some of those who prepared the report used it to express their views that government ownership of railroads is desirable. And the spotlight of attention was focused on this philosophy.

Failure of the National Resources Planning Board to live up to its potentialities does not mean that the nation can do without a national planning agency. One is needed now more than ever. Experience with the N.R.P.B., however, has shown that such an agency should be directly responsible to Congress, a creature of the legislative, not the executive, branch of government. Certainly, as we pass into the postwar readjustment period, Congress requires the advice of a detached agency on such matters as the use and disposition of our vast war plants and our greatly augmented power supply. And it needs this advice in straight factual language unencumbered with social theories.

Throughout the country, strong effort is being made to get public bodies and private companies to make definite plans for the postwar period. Some states have set up state-wide planning agencies. Conspicuously lacking is a national agency to advise Congress on broad national policies, to assist in integrating state plans and to coordinate the plans of the numerous federal departments. Establishment of such an agency should get the early attention of Congress when it reconvenes.

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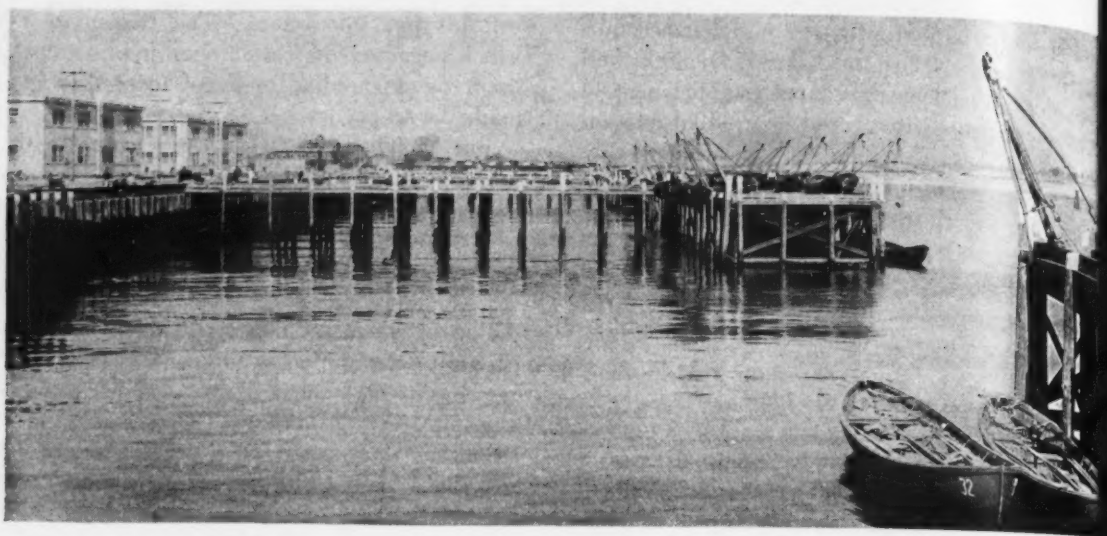

Fig. 1. Boat basins were formed within wharves equipped with davits for training in handling lifeboats.

Training Centers Constructed On a Beach Resort Site

***Contents in Brief**—Training schools and stations for the U. S. Coast Guard, the U. S. Maritime Service and a medical center for the U. S. Public Health Service were established at a site formerly occupied by an amusement park and summer cottages. Some resort buildings and cottages were converted to military use. Many new facilities were added in which the timber structures were designed to eliminate the use of critical sizes of lumber. Fireproof construction was adopted for the hospital, powerhouse, armory, brigs and fire stations, economy being obtained by a simple type of concrete block and concrete frame construction. Heat for all buildings is provided by a power plant in which marine boilers were installed to facilitate the training of seamen.*

TWO SCHOOLS FOR TRAINING over 16,000 enlisted men for the U. S. Coast Guard and the U. S. Maritime Service, also a large medical center for the U. S. Public Health Service, were put into commission on a seacoast site late last year, all within eight months of the letting of contracts. The first group of buildings was ready for occupancy within three months of the start of the work.

Characterized by President Roosevelt at the dedication ceremony as the largest maritime training center in the world, the combined projects occupy the site of a former amusement park and a section of a beach development with frontage both on the ocean and on an adjoining bay. Construction of the entire project was under the supervision of the U. S. Coast Guard. In addition to its size and the speed of construction, the project is notable for the complexity of the various design elements and the ingenuity with which the architects-engineers and the contractors worked out the problems of structural form and economy in use of critical materials.

The design problem

On March 20, 1942, the architects and engineers were given their assignment—to develop a scheme for housing 16,000 men, and providing accommodations for their induction, instruction, hospitalization, feeding and recreation on a site which wa largely sand beach, spotted with th cottages, bathhouses and other a purtenances of a seashore amusemen center. On April 20, the contractor received their contract and bega work at the site, and within thre months, on July 15, the first group o buildings was ready for occupancy During the progress of the job, $3 500,000 worth of additional wor comprising buildings not in the ori inal program was added to th project, making the final cost of lan buildings, utilities and docks approxi mately $25,000,000. The drawing and specifications for the added wor were prepared and the buildings con structed concurrent with the origina group.

The project was essentially com pleted in 120 days.

Site planning

The site planning and dispositio of the buildings was complicated b the fact that the property was a lon irregular strip of beach, with som structures of the original amusemen park in sufficiently sound conditio to save and utilize. For example, group of beach cottages was retaine as barracks; an adjacent street

brick houses was incorporated in the property for officers' residences; two outdoor swimming pools were enclosed for instruction purposes; two locker buildings were retained and remodeled as administration units; a beach restaurant and dance hall was likewise renovated for use as a canteen building. Despite these difficulties, a very reasonable and efficient site plan was worked out with barracks, classrooms, mess halls and recreational areas segregated and yet convenient to one another.

Two main arterial roads run through the project, one connecting to the city street that is the main approach to the property. Between the barracks there are streets intended solely for pedestrian traffic, to enable the large groups of men to evacuate the barracks and march to mess or class. At both the Maritime Service and the Coast Guard Schools an area was graded and developed as a drill field.

THE COMPLETED PROJECT CONSISTS OF THESE BUILDINGS AND UTILITIES.

Training School and Station for U. S. Coast Guard

Cost $6,800,000. 5,057 enlisted men

Seven dormitory barracks, 680 men each; receiving, quarantine and clothes storage building, 460 men; duty and headquarters building; brig and fire house; mess halls and galleys to feed 8,000 men; academic building; gymnasium, chapel and recreation building, 2,500 seats; canteen, general and social-service building; armory and small-bore range; garage and repair building; general storage and refrigeration building; gas training chamber; boat basin and dock.

Medical Center for U. S. Public Health Service

Cost $1,400,000.

Hospital	400 beds
Dental clinic	27 chairs
Pharmacist mates' dormitories	256 men

Training School and Station for U. S. Maritime Service

Cost $17,000,000. 11,500 enlisted men

Seven dormitory barracks, 1,360 men each; receiving and quarantine barracks, 720 men; staff barracks, 700 men; administrative office; two mess halls and galleys to feed 6,600 men each; boat repair shop and seamanship school; two academic and class-room buildings; gunnery and small-arm training building; pharmacist's mates' laboratory and class-room building; auditorium and gymnasium, 2,500 seats; swimming pools and sail-loft building; combined engine room instruction and powerhouse; oil storage building; electric switchhouse; receiving and clothes storage building; garage, brig and fire house; canteen; clothes scrubup building; general storage building; entrance-gate building; gas-training chamber; cargo-handling training rig; four boat basins and docks. In addition, there are roads, walks, and utilities for the entire project.

Type of barracks

The housing of so many men was accomplished by the use of two sizes of frame barracks capable of accommodating 1,360 and 680 men respectively. The basic unit is two-storied, and consists of a dormitory and a recreation space on the first floor, separated by a through hall, and two dormitory spaces on the second floor. Central toilet and shower facilities are provided. This basic unit is repeated twice to form the 680-man barracks, and four times to form the 1,360-man barracks. In each case, fire walls of masonry construction are built between units. In the dormitory rooms, individual wood lockers are so arranged as to subdivide the larger space into smaller units.

The mess-hall and galley buildings, of which three almost exactly similar were built, presented the most complex problem of any individual building. A total of 4,000 men must be fed at one sitting, and no time can be wasted in circulation. The plan provides for a central galley space, where the cooking equipment and the food preparation and storage spaces are located, with dishwashing units at

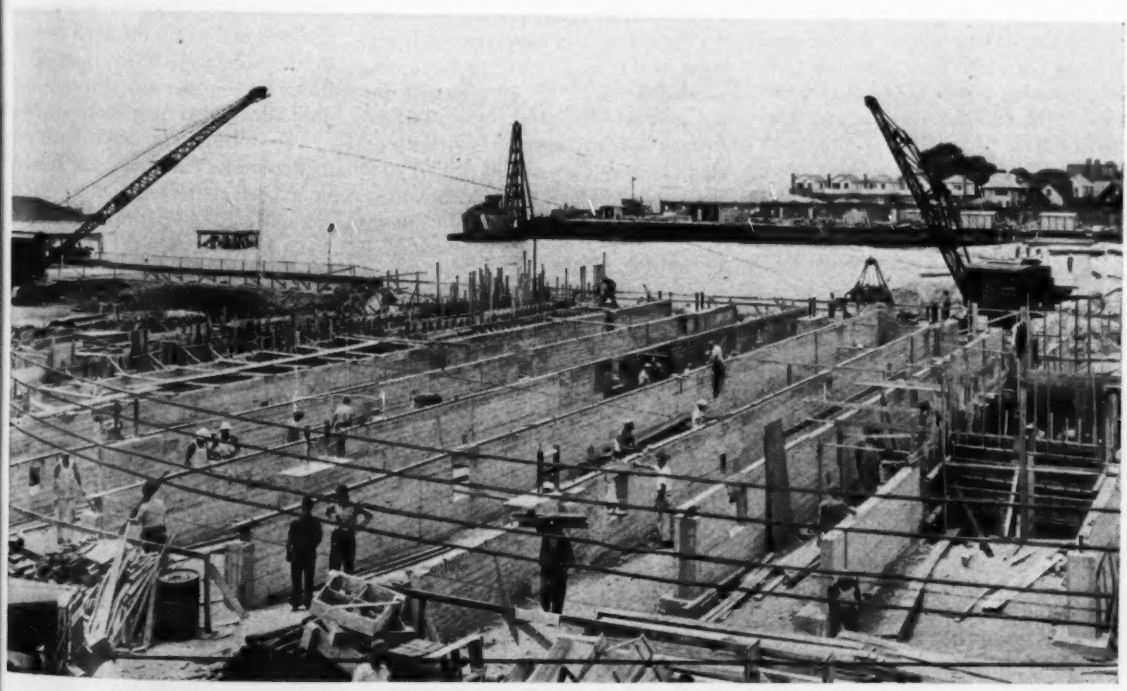

Fig. 2. Continuous concrete walls carry the floor joists of the mess-hall and galley buildings. Under normal conditions this practice would be uneconomic; it was employed here because of the scarcity of large timber.

Fig. 3. Exterior walls of the barracks were dimensioned to permit use of 4x8-ft. asbestos boards with a minimum of cutting. Window and post spacing was based on a modular design with this major economy in mind.

either end. Four mess rooms for enlisted men abut this galley space with the entrances, tables, serving counters and exits so arranged that there can be an almost continuous flow of men serving themselves in cafeteria fashion, allowing a possible total of 9,000 men to be fed in only one and one-half hours.

Officers have a separate mess room and pantry for table service. One of the buildings includes a bakery capable of producing 35,000 lb. of bread a day.

In the design of each mess hall and galley, extensive use is made of clerestory monitors to obtain adequate lighting and thorough ventilation of the large spaces. The result is a building covering two and one-third acres through which a tremendous amount of foot traffic moves and in which much work is accomplished, with all of the processes orderly and without any suggestion of confusion.

The receiving units presented an interesting problem in layout design, as several hundred men at a time—sometimes up to almost a thousand—are received and must be physically examined, registered, issued clothing and assigned to quarantine barracks. Circulation in these buildings was arranged so that the various induction processes are passed through in a "production line" manner. To keep the flow fast and uniform, each element of the process had to be supplemented by floor space sufficient for the necessary clerical force, tailors, storage of clothing, etc. Clothing alone required a vast amount of storage space to stock sizes for so many men.

A 400-bed hospital

The most interesting single building is the 400-bed hospital situated midway between the Coast Guard and Maritime Service Training centers, close to the ocean. It is administered by the U. S. Public Health Service. A T-shaped structure with the main wing facing south on the paved promenade along the waterfront where ambulant and wheel-chair patients can bask in the sun, it is a three-story fireproof building designed to meet the medical needs of the 16,000 men and to provide medical service for the families of a large resident staff. On the first floor are the administrative offices, out-patient department, galley and mess rooms and one ward wing. The second floor includes a surgical ward wing, an officers' ward wing and medical wing, which terminates in an isolation pavilion. The third floor, which covers only the central unit, is devoted to an operating suite, with three operating rooms and auxiliary spaces. The ward wings are subdivided into eight-bed spaces, separated from one another by glass partitions and from the corridor only by low screen walls.

Along the bay, a boat basin was developed for the Maritime Service by the construction of five docks, three T-shaped and two, at the ends, L-shaped, on which davits have been installed capable of swinging 130 lifeboats into the water. Out on the beach, advantage was taken of a natural cove to build a training center for the Coast Guard. A pier and breakwater were built across the mouth of the bay to protect the small boats which are fastened in the basin. A marine railway was constructed from the beach to the boat shed.

Largely frame construction

The larger part of the project is constructed of timber—balloon framing using 2x6-in. studs for exterior walls. Full advantage was taken of the inherent stiffness of the wall construction, and bracing members were reduced to a minimum. The roof construction was designed as horizontal girders, delivering the wind reactions to the side walls. The framing was designed to make use of timber available in the metropolitan area.

The contractors effected economy and speed by cutting timber members in a central mill set up on the site, assembling wall panels at the site of each building on the ground, and raising them with cranes in sections about 40 ft. long.

Footings, generally, rest on filled ground, a large part of which is hydraulic fill, which had been in place many years. Soil loading tests substantiated a belief that a soil value comparable to undisturbed sand could be assumed, which eliminated the need for a great deal of excavation and foundation construction. The foundation system consisted for the most part of concrete piers supporting built-up wooden girders at the first floor level. As the job progressed girders became unobtainable and use was made of concrete crosswalls, spaced on the basis of available floor-joist lengths, on which the joists

could rest directly. This arrangement eliminated much lumber in critical lengths.

Foundation walls and footings, in most places were of unreinforced concrete.

Insulated roofs and walls

Roofs, except for the central galley portions of the mess halls, and the trussed structures, are flat, pitching approximately an eighth of an inch to the foot. Both roofs and side walls are insulated with rock wool, this despite the fact that an insulating board is used for wall sheathing, in order to conserve metal in heating units by decreasing the amount of radiation required. Roofs are finished with three-ply built-up tar and gravel, terminating at a built-up wooden gravel stop.

Walls of the frame buildings are sheathed with an impregnated rigid insulation board, and faced on the outside with $\frac{3}{16}$-in. cement-asbestos board. All buildings were designed both as to story heights and window spacing to utilize full sheets, thereby keeping cutting to a minimum. Where sheets abut vertically, the joints are caulked.

Interior faces of outside walls and partitions, generally, are covered with fiber wallboard, left unpainted in all but such spaces as classrooms and recreation rooms. Where a sanitary, cleanable surface was considered necessary, a glazed surface asbestos board was used. Only in showers and some of the galley spaces was tile used, and there an asbestos board backing on the studs was waterproofed with saturated fabric to which the tile was glued with a waterproof cement.

Floors throughout most of the buildings were covered with asphalt tile laid directly on plywood subflooring. In order to prevent the finished flooring from buckling, joints between plywood sheets, where joists did not occur, were reinforced with intermediate catting. Ceilings in all spaces where noise might originate were covered with an inexpensive fiber acoustic tile, nailed to 1x2-in. wood strips, which were fastened to the ceiling joists. This added tremendously to the livability of the buildings without adding appreciably to their cost.

Composition flooring having a magnesite base laid directly on the plywood subfloor was used in the

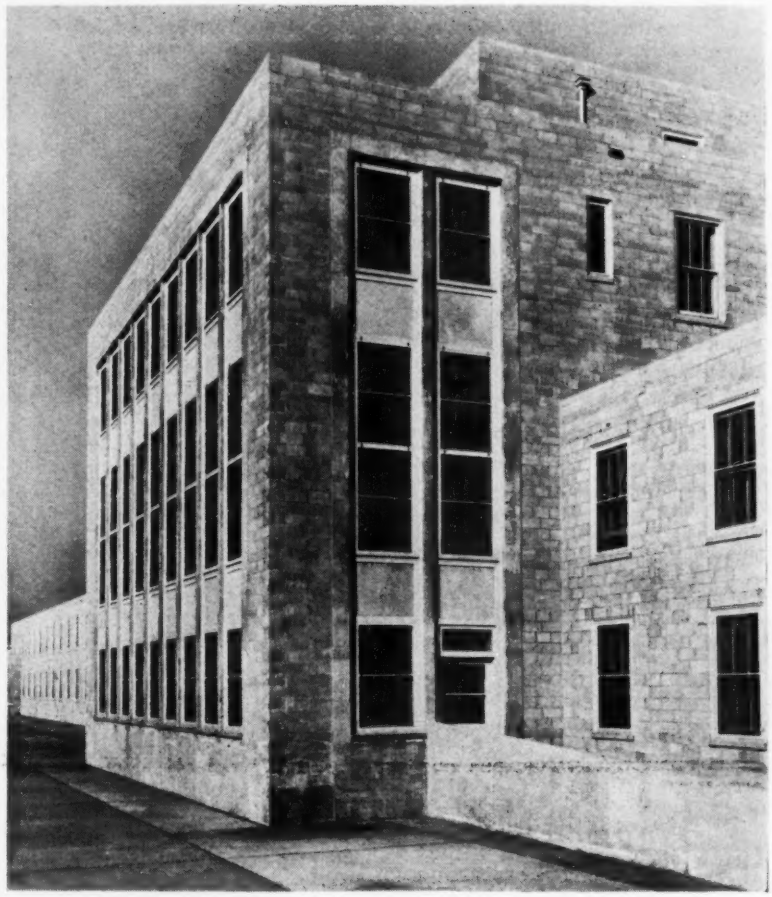

Fig. 4. The pleasing texture produced by the concrete blocks and concrete window framing of the hospital is shown in this view of the solarium. Spandrels are of cement-asbestos board.

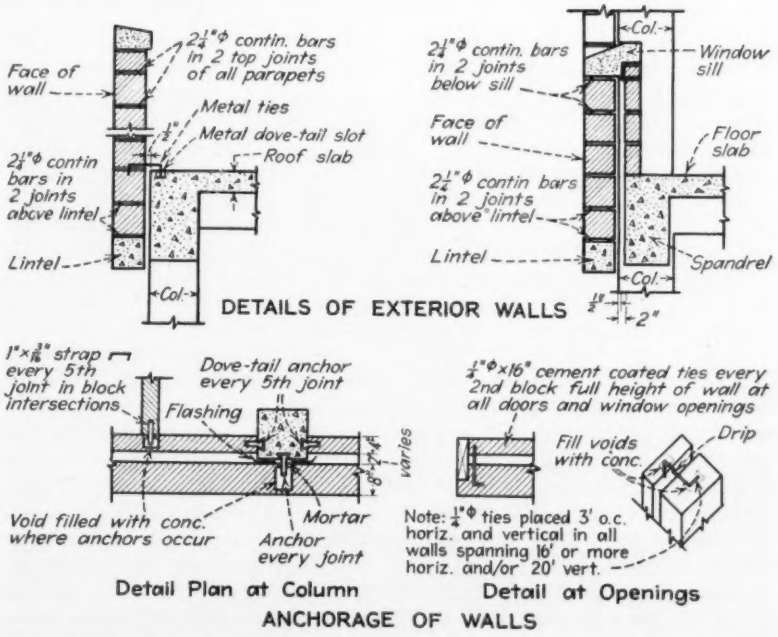
Face of wall
2¼"Φ contin. bars in 2 top joints of all parapets
Metal ties
Metal dove-tail slot
Roof slab
2¼"Φ contin bars in 2 joints above lintel
Lintel
Col.
2¼"Φ contin. bars in 2 joints below sill
Window sill
Face of wall
Floor slab
2¼"Φ contin bars in 2 joints above lintel
Lintel
Col.
Spandrel
2"
DETAILS OF EXTERIOR WALLS
1"×¾" strap every 5th joint in block intersections
Dove-tail anchor every 5th joint
Flashing
varies
Void filled with conc. where anchors occur
Mortar
Anchor every joint
Detail Plan at Column
¼"Φ×16" cement coated ties every 2nd block full height of wall at all doors and window openings
Fill voids with conc.
Drip
Note: ¼"Φ ties placed 3' o.c. horiz. and vertical in all walls spanning 16' or more horiz. and/or 20' vert.
Detail at Openings
ANCHORAGE OF WALLS

Fig. 5. Walls for the fireproof buildings were built of concrete blocks, employing a design that gave a maximum of insulation between the exterior and interior faces. Details of flashing and waterproofing are not shown in this drawing.

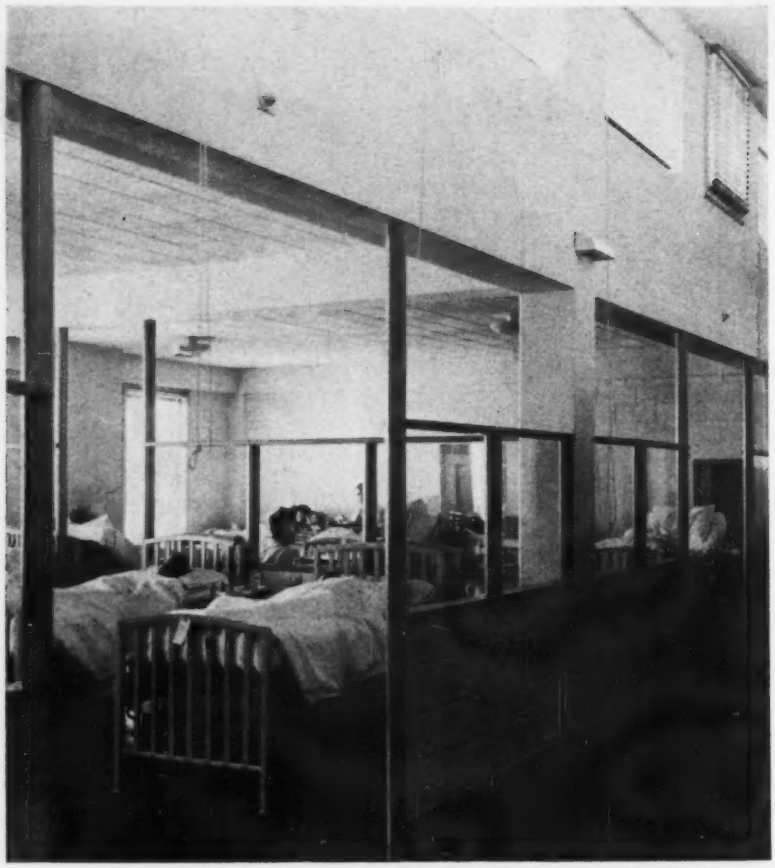

Fig. 6. Wall spaces in the hospital are subdivided and separated from the corridors by masonry screen walls topped with a simple wood and glass screen. Glass panels can be replaced by sliding them in a slot. A clerestory the entire length of the corridor gives light and ventilation in the central section of each wing where it is most needed.

galleys. Experience has shown that a flooring more resistant to fruit and vegetable juices, such as concrete, would have been better in the vegetable preparation spaces.

The auditoriums and swimming-pool enclosure are frame structures with wood trussed roofs. For the pool enclosure, which is a building area of 47,000 sq. ft. enclosing two pools, each 70 x 170 ft., the existing pool walls were utilized as foundation girders, on which the wood columns which carry the 36 trusses are supported. The trusses for the auditoriums are bowstring types spanning the full 112-ft. 6-in. width of the building. Top chords are laminated of 2x4's, glued, nailed, and bolted, while the other members are structural timber. In all cases, the trusses were designed to use a minimum of critical materials; for example, gusset plates for connection to columns and for all lower chord connections are of plywood.

Several buildings which it was felt should be of fireproof construction—the hospital, powerhouse, armory, brigs and fire stations—were constructed of concrete block walls enclosing a framework of concrete columns and slagblock slab-floor construction. The wall blocks rest on concrete foundation walls or grade beams supported on concrete posts. An admixture was used in the block mortar to prevent mortar shrinkage.

The architect-engineer perfected a use of the wall block which gave a result far above the ordinary. Four colors of mix were used, an irregular surface texture was obtained, and the blocks were laid in 4, 6 and 8-in. courses with irregular vertical joints. Thus there was no monotonous regularity, an extremely interesting surface resulted, and a wall was obtained that had the character of cut-stone—and yet had its own "personality"—at the cost of concrete block.

A double wall was erected, consisting of an 8-in. thick block on the outside, then a 2-in. air space, and finally a 4-in. inside wall, with the inside face of the exterior wall dampproofed by a mastic compound applied by trowel. A large amount of spandrel flashing was eliminated by recessing the spandrel beams so that their outside surface was flush with the outside line of the inside 4-in. wall. This allows the moisture of condensation to run unobstructed down to the grade beam where it drains to the outside. Thus a watertight, insulated wall was obtained, as well as an inexpensive and good looking one. Where interior surfaces required paint, a resin-emulsion paint was applied directly to the concrete blocks.

The use of this type of construction in conjunction with the slab-lock floor system made possible a masonry building, fireproof and as permanent as desired, with a minimum of steel reinforcing. The economy of the construction is demonstrated by the fact that the hospital building was erected for a cost of $2,100 a bed, an unusually low cost for a well planned masonry hospital.

Special framing in power house

In the power house, due to the spacing of the boilers, the columns were placed quite far apart. The inherent strength of the 8-in. concrete block wall as a vertical slab was taken advantage of by reinforcing the joints with ¼-in. bars at critical places. Thus the wall itself, at a minimum cost, was made strong enough without the necessity of introducing bracing members.

The power house was designed primarily for training purposes. It contains four pairs of marine water-tube boilers identical in design and capacity to those used on the Liberty ships, as well as all auxiliaries. In the case of three of the groups of boilers the equipment is arranged for easy demonstration in the teaching of student merchant seamen, but in the fourth pair the boilers together with their auxiliary equipment are arranged to duplicate as nearly as possible the design and arrangement in a Liberty ship. This fourth pair of boilers is set in an instruction room, where there is also set up a triple expansion marine engine identical in design with the engine of a Liberty ship, together with its auxiliary equipment.

To train the men to use the type of

boiler used on the British Liberty ships, two Scotch marine boilers were installed along with their auxiliary equipment. Steam is generated at 225 lb. and reduced to 60 lb. for distribution.

Plumbing and heating

Each building has its own equipment room, with a cement-lined hot-water tank with steel tubes, and its own hot-water circulating system operated by a self-contained motor-driven circulating pump. Critical materials were avoided by using vitreous china or porcelain plumbing fixtures with cast iron trimmings, plastic coated or galvanized, and with plastic tubing as connections between flush valves and fixtures.

The heating system is a two-pipe vacuum system with the piping in the crawl space under the first floor of the buildings. Steam is distributed by means of underground welded pipe in prefabricated insulated conduit.

In all rooms large enough to warrant it, unit heaters have been installed, thus reducing the amount of critical iron or steel that would have been required for radiators such as are used in small rooms. Half of the unit heaters are equipped with outdoor connections with dampers adjustable to allow any proportion from 100 percent of outside air to 100 percent of inside air. This assembly, which was built entirely of wood and wallboard, facilitates ventilation and is particularly useful during blackouts.

Electrical power is supplied by a local utility and distributed overhead.

The buildings, generally, have panel boards built in two sections—one controlling circuits which must be turned off during blackout periods and the other controlling circuits which must be alive at all times.

Underground distribution was employed for firealarm and loudspeaker systems, using a cable that contains the wires for both systems, thus reducing both installation and maintenance costs.

The loudspeaker system was designed to fulfill several important functions—to provide a means of issuing general orders simultaneously to the entire station; to provide an air-raid warning system; to supplement the fire alarm system by providing emergency and disaster signals coupled with oral instructions as to procedure; and finally to provide a means of locating personnel quickly. Efficient design kept the equipment cost of this loudspeaker system down to $0.80 per capita of population.

Water supply and sewage disposal presented no great problems as it was possible in the case of both utilities to connect to existing city systems, which the city cooperatively extended to the site. Storm water is discharged through the seawall to the ocean. When the construction began, cement-asbestos pipe was available and was specified as a noncritical material for water pipe, but as the job advanced that material became critical, and the last 3,000 ft. of water pipe laid was California redwood. Slip-seal tile pipe was used for sanitary and storm sewers.

Roads and streets

The construction of roads was determined by the factors that a large population has to be serviced, on a flat, closely built site, with all roads required to be capable of carrying the load imposed by a 40,000-lb. crane. The design which satisfied these requirements best was an 8-in. concrete slab with all dowels and steel reinforcing omitted, in order to conserve critical materials. Both the roads and the walks, which are also of concrete, were treated with a darkening agent. In the case of the roads, this was a bituminous curing compound, and for the walks, a 2-in. deep impregnation of carbon black (three pounds to a bag of cement) was used for the double purpose of reducing seaside sun glare and as a camouflage agent against possible bombing. The entire unbuilt and unpaved area was covered with a thin layer of clay and top soil, and then planted with a hardy grass, to prevent the sand from blowing and to reduce glare.

The speed with which this tremendous volume of construction was completed would not have been possible without the closest coordination and cooperation among the architects-engineers, Alfred Hopkins & Associates; the general contractor, the George A. Fuller Company; and the government's constructing agency, the U. S. Coast Guard (Rear Admiral Harvey F. Johnson, Engineer in Chief; Captain R. R. Tinkham, Chief, Civil Engineering Division). All purchasing as well as administrative supervision on the job was done by the contractor from a field office established on the site, and since there were representatives of the architects-engineers on the job, and the supervising officers for the Coast Guard, Comdr. L. D. Edwards and Lt. Comdr. K. W. Donnell, were immediately available at all times, it was possible to make rapid decisions, obtain authorizations, and carry out the work without delay. There was a sincere desire on the part of everyone connected with the project to do a good job in the shortest possible time, and as a result misunderstandings, hesitations, and delays were non-existent.

Fig. 7. Interior of the galley space in one of the three mess-hall and galley buildings. Clerestory monitors provide both light and ventilation.

Simplified Equations for Concrete Beams

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***Contents in Brief**—Simplified equations that will speed selection of the correct size of concrete beams reinforced for both tension and compression are made available. By use of the formulas, designers may quickly prepare tables for concrete similar to those available for steel sections in structural steel handbooks. Use of equations is explained by illustrative example.*

To SAVE TIME in designing complicated doubly reinforced concrete sections, simplified formulas are here presented to permit tables of concrete sections to be prepared by the same principles as structural steel tables. The data for a small number of sections covering a fairly wide range of capacities can be prepared in a short time and used to advantage in estimating and adjusting intermediate sizes. Thus, with the present widespread substitution of reinforced concrete for steel and the urgency to save time and material in structural design, the formulas may be helpful to other engineers.

The formulas currently in use for solving doubly reinforced concrete beams involve small decimal factors and their squares and square roots and are tedious to apply and difficult to memorize. Some years ago, the writer analyzed this problem with a view to bringing it into focus. The result was development of the equation

$$dA_t + ZA_c = \frac{by^2}{2n} + y\,(A_c + A_t) \qquad (1)$$

In this equation A_c = area of compressive reinforcement in sq.in.; A_t = area of tension reinforcement in sq.in.; and $n = \frac{E_s}{E_c}$. The other dimensional factors are shown in Fig. 1 and all are expressed in inches. The equation shows the co-relation of the seven factors in the problem and each factor is variable. For solutions, values may be assigned to any six factors and the seventh is automatically established and its value determined.

Equation 1 is derived from standard technical principles with the slight exception that the deduction for the concrete displaced by the compression steel has been disregarded. In the theoretically exact principle the equivalent compression area afforded by the steel is represented by $(n - 1)\,A_c$. The discrepancy in neglecting the "minus one" is very small, and, in agreement with several text book authorities, the author uses simply nA_c. The derivation of Equation 1 is quite lengthy and for space reasons is omitted.

From Equation 1, the following equations may be derived:

$$A_c = \frac{(d - y)\,A_t - \frac{by^2}{2n}}{y - z} \qquad (2)$$

$$A_t = \frac{\frac{by^2}{2n} \pm y\,A_c - Z\,A_c}{d - y} \qquad (3)$$

$$b = \left[d\,A_t + ZA_c - y\,(A_c + A_t)\right]\frac{2n}{y^2} \qquad (4)$$

$$d = \frac{\frac{by^2}{2n} + y\,(A_c + A_t) - Z\,A_c}{A_t} \qquad (5)$$

$$y = \sqrt{(dA_t + ZA_c)\frac{2n}{b} + \left[(A_t + A_c)\frac{n}{b}\right]^2} - (A_c + A_t)\frac{n}{b} \qquad (6)$$

$$Z = \frac{\frac{by^2}{2n} + y\,(A_c + A_t) - dA_t}{A_c} \qquad (7)$$

Of Equations 2 to 7 the one most commonly used is Equation 6, but the experienced designer will quickly recognize the flexibility afforded by the other derivatives in dealing with such problems. The equations give the same results as the formulas in current use, but their advantage is that actual dimensions in inches and areas in square inches are used and results are yielded in the same terms. Computation is thus greatly simplified. Except for the factor y, which involves solution of a quadratic equation, one need only strike an arithmetical balance of Equation 1 to find the seventh unknown factor. The writer finds this form easy to remember and with the exception of n, which is not a dimensional term, has, at various times, found occasion to solve for all other six variables.

Like an unsymmetrical steel section, such as an angle or a tee, a reinforced concrete section has two section modulus values, one for compression and the other for tension. When all the factors in Equation 1 have been determined, the section modulus values in both tension and compression are automatically set, as is also the value of the lever arm a.

With all the factors in Equation 1 determined the section modulus value in compression becomes:

$$S_c = \frac{by}{2}\left(d - \frac{y}{3}\right) + \left[\frac{n\,A_c\,(y - z)}{y}\right](d - z) \qquad (8)$$

By knowing S_c the value of lever arm a may be computed as follows:

$$a = \frac{S_c}{\frac{by}{2} + \frac{n\,A_c\,(y - z)}{y}} \qquad (9)$$

The section modulus value in tension becomes

$$S_t = A_t\,a \qquad (10)$$

And the moment of inertia about the flexural neutral axis is

$$I_f = \frac{by^3}{3} + n\,A_c\,(y - z)^2 + n\,A_t y_t^2 \qquad (11)$$

To obtain the moment of inertia about the gravity axis I_g the author follows the standard method of locating the gravity axis and summing moments of inertia of area elements above and below that axis, multiplying A_t and A_c by n in the process.

To illustrate the process of working out the complete technical functions of a doubly reinforced concrete section the following example is given. Assume the dimensions in Fig. 1 are as follows: b = 14 in; d = 21 in.; t = 23 in.; Z = 2 in.; A_t = 2.0 sq.in. (two 1-in. rods); A_c =

2.53 sq.in. (two $1\frac{1}{8}$-in. rods); f'_c = 3,000 psi. and $n = 10$.

Then, from Eq. 6,

$$y = \sqrt{(21\times2+2\times2.53)\frac{20}{14}+\left(\frac{4.53\times10}{14}\right)^2} - \frac{4.53\times10}{14} = 5.56 \text{ in.}$$

From Eq. 8,

$$S_t = \frac{14\times5.56\times19.15}{2}+\frac{25.3\times3.56\times19}{5.56} = 1{,}051.4 \text{ in.}^3$$

From Eq. 9,

$$a = \frac{1051.4}{\frac{14\times5.56}{2}+\frac{25.3\times3.56}{5.56}} = 19.07 \text{ in.}$$

From Eq. 10,

$$S_t = 2.00\times19.07 = 38.14 \text{ in.}^3$$

From Eq. 11,

$$I_t = \frac{14\times5.56^3}{3}+25.3\times3.36^2+20\times15.44^2 = 5{,}85\ 5.7 \text{ in.}^4$$

And by taking moments, $I_t = 18{,}443$ in.^{4}

Assume the above section to be

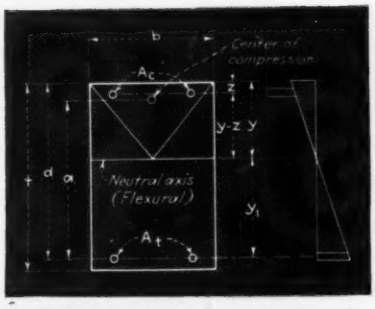


Fig. 1. Cross-section through reinforced-concrete beam of type for which the accompanying formulas are applicable.

under a bending moment of 900,000 in.-lb., the maximum compression concrete stress $= \frac{M}{S_t} = \frac{900\,000}{1{,}051.4}$ = 855 psi.

Stress steel in tension $= \frac{M}{S_t} = \frac{900{,}000}{38.14} = 23{,}600$ psi.

The writer has computed four sets of tables for n equaling 8, 10, 12, and 15. Each set consists of sixteen sections. By systematizing and tabulating the factors the entire 64 cases were worked out quickly.

It is interesting to note the difference between the inertia value about the flexural axis in the example given and the value arrived at by following standard codes. In the latter the moments of inertia of gross concrete sections are suggested for rigid frame analysis. Since stiffness factors depend partly on inertia values, and stress analysis can be no more accurate than the validity of assumptions with respect thereto, designers may find it interesting to estimate the inertia values that may be operative in their designs and to compare with the code suggestions. Here again, tables of section properties will simplify the process.

Job-Made Crane Frame for Heavy Loads

In construction of the plant for Basic Magnesium, Inc., near Las Vegas, Nev., it was necessary to unload heavy electrical equipment before the arrival of an overhead crane with which it had been intended to do this work. Nine 60-ton units had to be lifted and lesser loads (exceeding 30 tons) had to be raised to a height of 33 ft. in the unloading process. This work was done safely and speedily with a temporary rig devised and put together on the job as described in the following.

Round cedar poles were available in the lengths necessary to make up a frame such as that shown in the accompanying illustrations. A pair of 55-ft. poles was set up on each of the four corners of a square measuring 12 ft. on a side. (This width was ample to span the railroad siding on which the loads came in on special flatcars.) Sixty-foot poles, placed on a batter, were used as braces on the two sides, all the poles being set on concrete footings. The plumb posts had tip (top) diameters of about 8 in. and base diameters of about 20 in. Corresponding dimensions on the batter poles were the same. The capping at the top of the pole frame was made of 16x16-in. timbers.

Set atop of the timber framing was a five-sheave crown block such as is commonly used in oil well drilling operations. This block and its sheaves weighed 7 tons. Bracing parallel to the siding was provided by $\frac{5}{8}$-in. stranded wire cables. The tower structure and the adjoining housing for equipment were enclosed with building paper to exclude the desert dust. Power was supplied by a Ford V-8 motor anchored to a timber deadman.

The structure was designed, the materials were assembled and erection was completed ready for service in a period of 10 days. To prove that the improvised framing had adequate strength, a standard 10,000-gal. railroad tank car full of water was spotted beneath the rig and this 70 ton load was picked up without any large deflection of the frame.

This rig was designed and assembled under the direction of C. P. Weaver, superintendent, Ziebarth Construction Co., electrical contractor on the job.

Fig. 1. Unloading rig, improvised on short notice, uses frame of round poles.

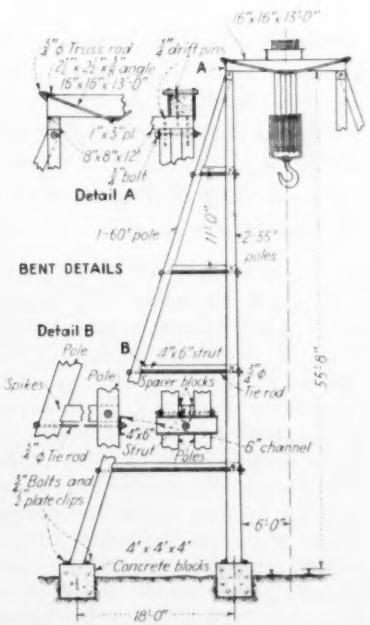


Fig. 2. Two bents of type above were added on each side of track.

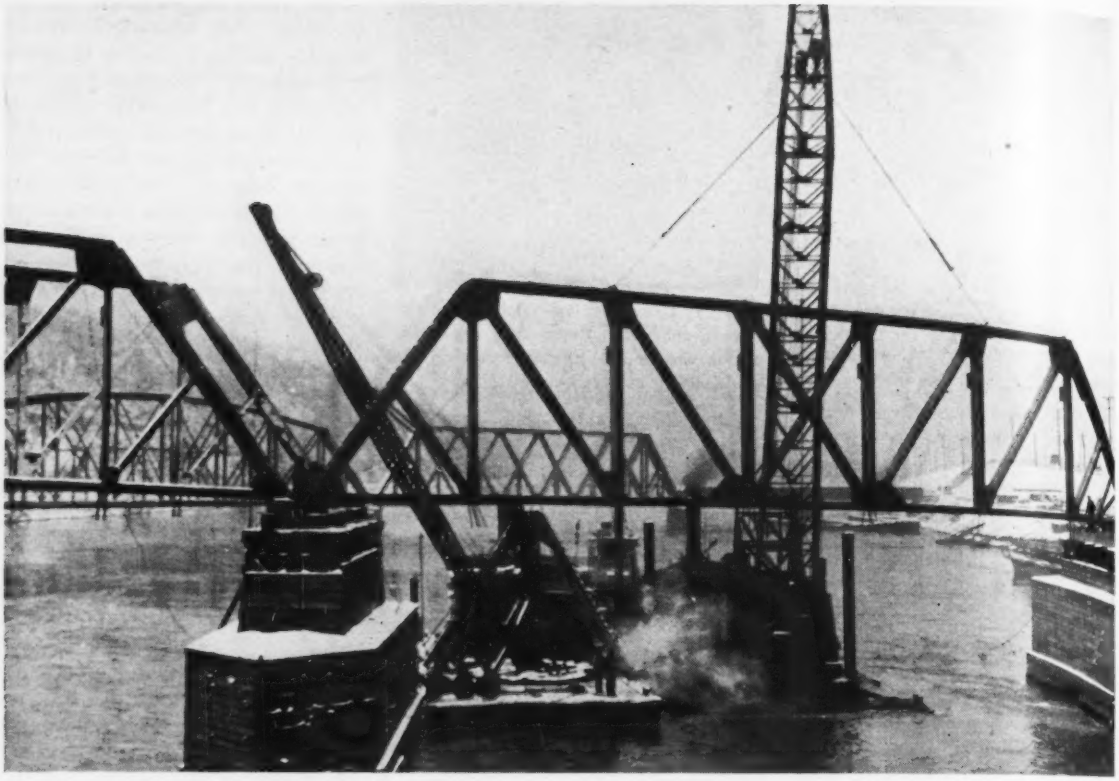


Fig. 1. Assembled on land or on barges, the 129-ft. timber trusses were erected by a 35-ton derrick with a 110-ft. boom.

River Bridge of All-Timber Construction

***Contents in Brief**—On an access road in Pennsylvania, a timber bridge consisting of six 129-ft. truss spans with steel gusset plates was constructed across a channel of the Ohio River. The structure is supported on timber piers carried on piles and rock-filled cribs. After the cribs were floated into place, the corner piles were driven, the cribs sunk and the rest of the piles put down. The trusses were assembled on barges and erected one at a time by a floating rig.*

RECENTLY COMPLETED on an access road in Pennsylvania is a timber bridge that illustrates how timber may be combined with a small amount of steel to produce a semi-permanent structure. The crossing also suggests that timber bridges may be so constructed as to require little maintenance. In addition, the superstructure erection shows that timber bridge trusses may be assembled and erected in a short time despite bad weather. Furthermore, the foundation work is of interest because timber cribs to encase the wood piling were sunk in a swift current.

The crossing is located near Pittsburgh and spans a channel of the Ohio River where swift currents are common. The structure not only had to carry heavy truck traffic but also a single street car track. To meet these demands, six timber Pratt through truss-spans 129 ft. 6 in. long were used for the main crossing. The six spans combined with 329 ft. of timber approach trestle make the overall length 1,100 ft. The trusses are spaced 27 ft. 6 in. center to center, providing a 24-ft. roadway designed to carry 13-ton trucks and 30-ton street cars.

To reduce critical materials in the foundations to a minimum, the final plan permitted the approach trestles to be supported on plain and reinforced-concrete footings but required the river foundations to be of timber construction. Thus, each river pier is supported on two groups of 25 southern pine piles having 8-in. minimum tips and 12-in. butts. The piles are spaced on 3-ft. centers each way and each group is enclosed by a 20 x 20-ft. rock-filled timber crib.

The cribs are of bolted construction, of varying height, and spaced 11 ft. apart as shown in Fig. 2. The crib walls are 3 x 10-in. horizontal planking. Outside of these timbers four 12 x 12-in. vertical posts are used on each side and they are banded together with 12 x 12-in. horizontal wales on a 6-ft. maximum spacing.

Each crib is closed at the bottom by 12 x 12-in. two-way bracing and 4 x 12-in. planking, except for the

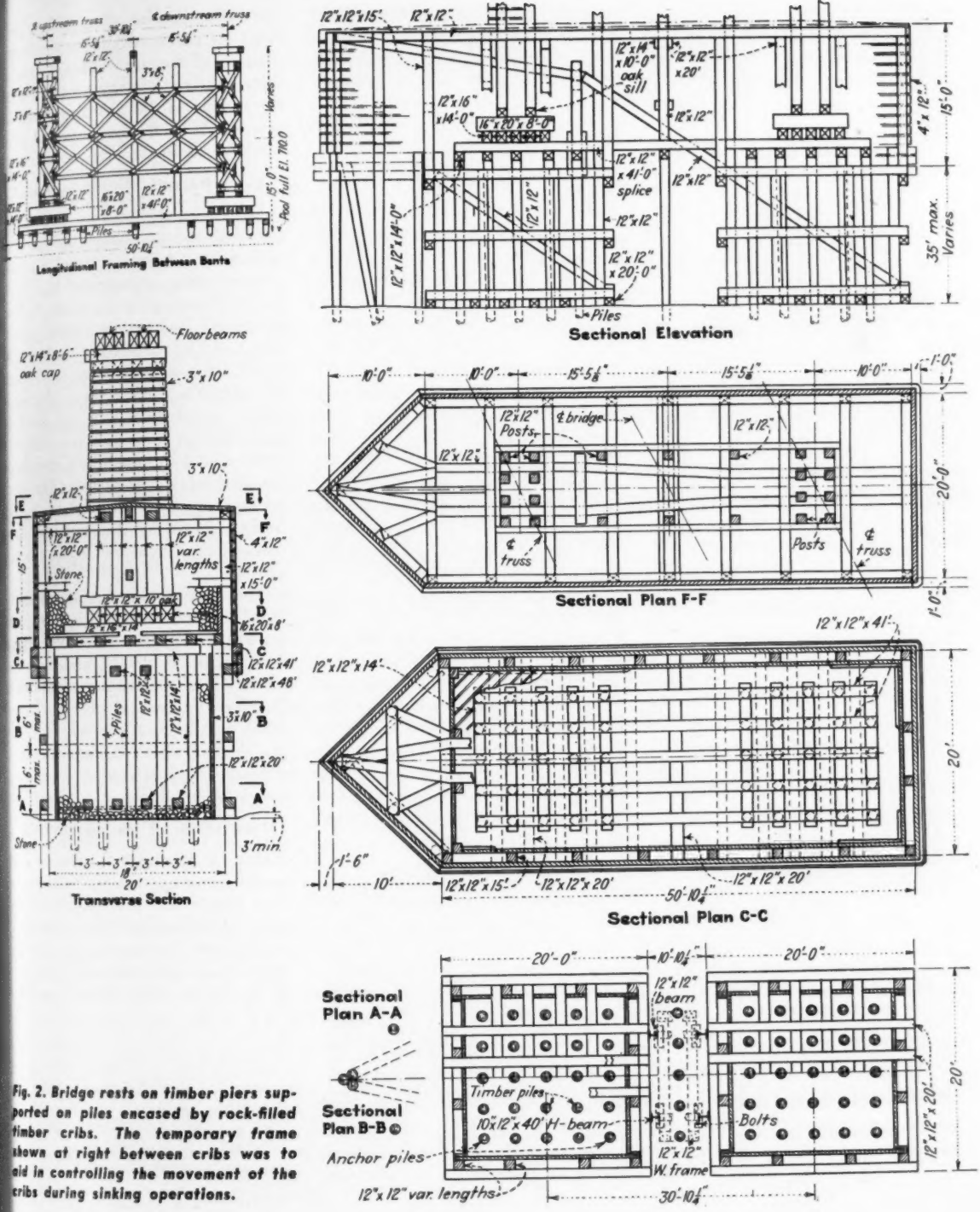


Fig. 2. Bridge rests on timber piers supported on piles encased by rock-filled timber cribs. The temporary frame shown at right between cribs was to aid in controlling the movement of the cribs during sinking operations.

14-in. square openings for the piles. The piles are cut off 2 ft. above normal pool level and capped by transverse 12 x 12-in. timbers and similar longitudinal timbers on a 3-ft. spacing. Over the last timbers is added a 3 x 12-in. planking to close the top of the crib.

On this deck are first placed five 12 x 16-in. transverse timbers spaced a few inches apart, then five 16 x 20-in. longitudinal members 8 ft. long, and finally two 12 x 14-in. oak sills 10 ft. long that support the eight 12 x 12-in. posts forming the tower.

The posts are capped by 12 x 14-in. oak timbers that support two 14 x 20-in. floorbeams and four 12 x 20-in. bearing timbers, three under the end of each truss, that support the trusses.

For about 15 ft. above where the piles are cut off the pier is encased in 4 x 12-in. random length timbers and this enclosure is decked over with 3 x 10's. The remaining height of the pier is solidly encased with

3 x 10-in. planking, as shown by the drawing on the previous page.

The foundations were constructed across a channel where swift currents are encountered and sudden fluctuations of the river stage occur. Since the timber cribs are higher than they are wide, care had to be exercised in constructing the foundations. In addition, severe winter weather added to the difficulty of the work. Before the cribs were sunk, 3 ft. or more of the river bed was removed at each foundation site by use of a clamshell bucket handled by a floating rig. This work exposed a sand of good quality. In sinking the cribs, which were assembled on shore and floated into place, work was completed at one pier at a time.

Cribs sunk one at a time

The two cribs for each foundation were tied together by the temporary sliding connection shown in Fig. 2 and floated into place as a unit, but the upstream crib was sunk first. The four corner piles required within the crib were driven to hold the crib in the desired position. These piles passed through 14-in. square openings in the crib bottom. They were driven to a 20-ton bearing, as figured by the *Engineering News* formula, by a double-acting, 7,000-lb. steam hammer handled by a 35-ton floating rig with a 110-ft. boom.

The other 21 piles required in each crib were set in the 14-in. holes provided but were not driven until after the crib had been loaded with stone and sunk to within about two feet of its final bearing on the river bottom. When the pier had been thus filled, the remaining piles were driven. This method was adopted as being simpler than one in which the cribs would have to be fitted over the piles after they had been driven, some piles possibly being out of line.

The pile penetration below the cribs was 25 to 30 ft. and the maximum depth of water above the crib bottom was 35 ft.

In sinking the second crib, which remained joined to the upstream crib by the sliding connection shown in Fig. 2, the procedure was much the same as for the first crib. With both cribs in place, the frame or tie between cribs was removed and the piling between the cribs driven. While this work was in progress, the cribs were filled with stone to about water level. Work was then discontinued at this pier for a few days to permit any settlement that might occur.

At the end of this period, the piles were cut off 2 ft. above normal water level, the transverse and longitudinal caps added, the remainder of the fill placed, and the crib closed by addition of the 3 x 12-in. plank deck. Purpose of the rock fill was not only to protect the timber piles, but to also increase the weight of the piers to provide greater resistance to the swift currents, ice, and floating debris. To add still more stability and reduce resistance of the pier to the current, three piles were driven upstream from the foundation to provide a cutwater of the type shown by Fig. 2.

Bents erected as units

With the sills and supporting timbers in place, the towers, each consisting of eight 12 x 12-in. posts in two rows of four each, were set in place by the floating rig. The towers had been assembled as eight-post units on shore. Addition of the remainder of the pier cribbing followed immediately. It is to be noted that the outline of the pier is reduced in size about 15 ft. above normal pool level, as shown in Fig. 2.

Superstructure timbers untreated

Construction of the superstructure followed closely behind the foundation work. A typical truss for the superstructure is illustrated by Fig. 3. As this drawing shows, all the timber members frame into steel gusset plates. All of these truss timbers are structural grade Douglas fir. Where the members join the gusset plates the timber in contact with the steel is protected by two coats of creosote paint added by brush, but elsewhere the timbers are untreated. The portal and top chord bracing also are of timber, except for the steel-rod diagonals of the lateral bracing in the top chord.

The roadway framing and decking is of timber construction, as illustrated in Fig. 3. Unusually large floorbeams, 20 x 30-in. timbers, were used. All of the roadway framing is Douglas fir, except the laminated white oak floor. A bituminous wearing surface with a 2½-in. crown and a minimum thickness of 1 in. completes the roadway.

Construction of the superstructure

One of the spans is entirely over land, spanning several railroad tracks. The trusses for this span were assembled in place on timber falsework. In contrast the trusses for the five river spans were assembled on land or on barges and erected one at a

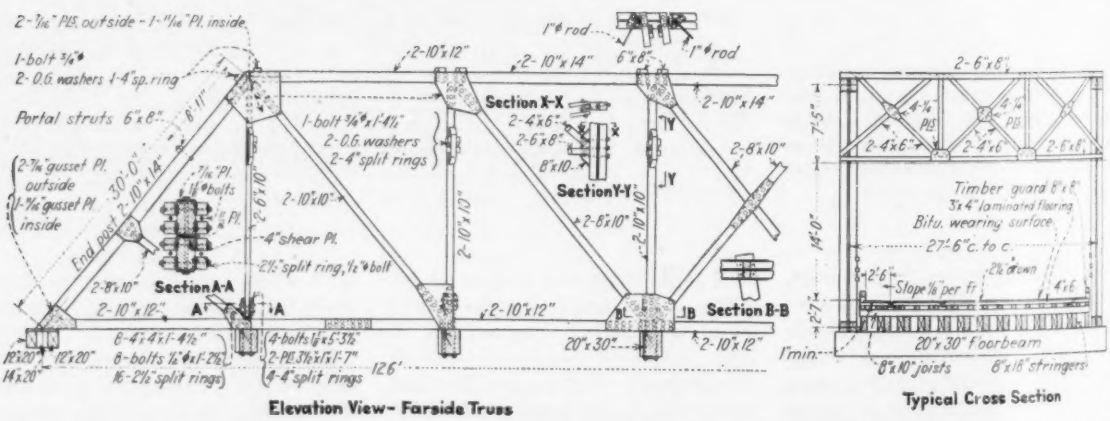


Fig. 3. The trusses, of 126-ft. span, were constructed of structural grade fir, as was the floor system. Gusset plates are of steel. Split ring connectors were used at the joints. The 20x30-in. floorbeams are a notable element of these timber trusses being called for by the wide roadway and heavy loading.

time. Those trusses assembled on land were transferred to the 130-ft. long steel deck barge by the 35-ton derrick boat equipped with a 110-ft. boom.

Erection of the trusses was by the 35-ton floating rig, and to lift a truss into place no stiffening of the member was necessary. Each truss weighed about 25 tons. Hitches were made to the second upper chord panel points or U_2 and U_3. The floating rig worked downstream from the piers and erected the upstream truss in each span first. As this truss was lowered into place it was braced at both ends by a tie on both the upstream and downstream side. The ties extended outward from the top chord to the pier. Each end of the truss was tied down by four 1½-in. dia. anchor bolts that extended down through the 14-in. timbers that cap the pier bents.

Trusses fixed at both ends

Both ends of the truss-spans were fixed. In completing the last span, so accurate had been the fabrication of the trusses and location of the piers that the anchor bolts for the upstream truss were but a fraction of an inch out of line. At the other side the bolts were 1½ in. from the holes, but the pier was easily pulled into line to complete the truss erection. Assembly and erection of the trusses required four weeks. This rapid progress was made despite prevailing heavy snows and severe winter weather.

Erection of the heavy floor timbers and the portal and top chord bracing was with a smaller floating rig, which followed closely behind the rig used for truss erection. The roadway deck under construction is shown in Fig. 4.

For the six river piers 115,000 b.ft. of timber was required for pile encasements and 195,000 b.ft. for the top portion of the substructure. In all 15,000 lin.ft. of wood piling was needed and the stone fill in the piers totaled 3,000 cu.yd. For the superstructure, including the approach spans, 680,000 b.ft. of lumber was required.

Miscellaneous steel and iron, including that for the gusset plates, shear plates, bolts, nuts, and turnbuckles, exclusive of spikes and nails in place, totaled 147 tons.

Cost of the completed crossing, including both of the approaches, totaled about $430,000.

Fig. 4. Construction of the floor-system followed closely behind truss erection. Included in the deck is a street-car track.

Fig. 5. The span at the south end, which is above several railroad tracks, was erected in place on temporary falsework bents. Trusses for the other spans were assembled off the site and set with floating equipment.

The construction work was carried out by the Civil Engineering Corps., U. S. Navy, Lt. Comdr. Joseph R. Wilson being officer-in-charge in the early stages of the work, and Lieut. J. B. Barnwell during last part of the work.

Plans for this timber bridge were prepared by the Department of Works of Allegheny County, John F. Laboon, director, Levi Bird Duff, chief engineer, and S. A. Shubin, bridge design engineer. Timber Structures, Inc., Portland, Ore., prepared the shop drawings.

The general contract was held by John F. Casey Co. and McCrady Construction Co. Associates, Pittsburgh. R. J. Munch was office engineer and project manager, and R. Roscoe Johnston general superintendent for the contractors.

ENGINEERING ABROAD AS SEEN BY ENR EDITORS

Engineer Troop Training in England

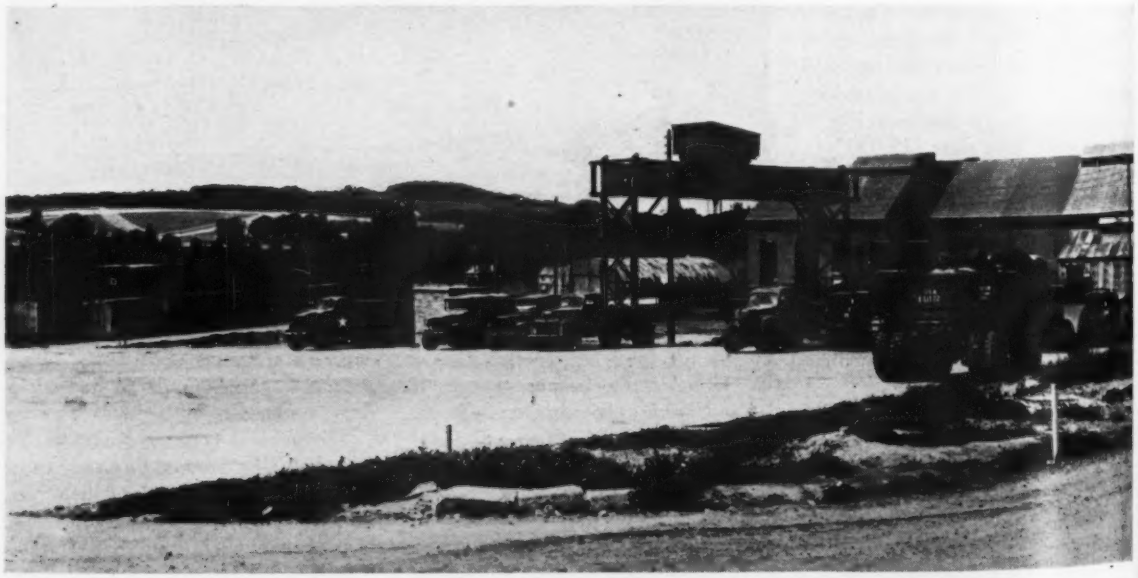
Waldo G. Bowman
Editor, Engineering News-Record
(By air mail from the European Theatre of Operations)

SOMEWHERE IN ENGLAND, JULY 15. With all the newspaper correspondents over here posing as experts on high strategy and detailed tactics as they relate to invasion, the temptation to do a little "experting" on Army Engineer invasion activities is too great to resist; particularly so since to be an expert one apparently needs only to state the obvious, without any ifs, ands, or buts. Thus: There will be an invasion. Army Engineer troops will have a prominent part in it. They are too busy now perfecting the technique of invasion to worry about where it will take place. And, anyway, so long as there is going to be an invasion somewhere, based on Britain, there are depots, camps, hospitals and airdromes to be built. So far as the Army Engineers are concerned, invasion is already under way.

An expert in expert analysis could probably keep this up indefinitely, but an ordinary muddy-shoe construction editor must get back to something approaching straight reporting. For example: Invasion training for combat engineers is a hash compounded of building and demolition. You build a pill box, according to German design, and then you storm it and blow it to bits and pieces. You construct a bridge and then sneak in under cover of darkness to place explosive charges that collapses it into an unusable pile of rubble or tangled steel. Or you practice erection of one of the Royal Engineers' splendid military highway or railway bridges, knowing full well that the German rear guard is going to leave few stream crossings intact.

All these operations and many more will be repeated again and again at selected spots in Britain. And most of them will be pointed to specific locations on the road to Berlin. To be sure of this, one has only to recall the elaborate preparations that preceded the successful air attack on the Ruhr Valley dams, preparations which, it may now be revealed, involved the construction and destruction of scale models of the actual structures.

In all of this work the Army Engineers are receiving the utmost aid



Heavy supplies arriving at this engineer depot are unloaded from rail cars using a job-built gantry crane.

U. S. Army Pictorial Service Photos

Emergency compacted-soil runway built by Engineer troops to permit a Fortress bomber to fly out of a farmer's field where it had made a forced landing on a return trip from Germany. The $4,500 estimated cost of building the runway was less than the cost of carting the plane away in pieces and reassembling it. At that, the pilot used less than half the length of the runway for his takeoff.

from the British Royal Engineers whose actual battle experience is beyond value at this time. Here is a good example of lend-lease in reverse. And it pays further dividends, for a friendship and mutual admiration is growing up between the two Engineer branches that should enhance Allied co-operation both in war and in peace.

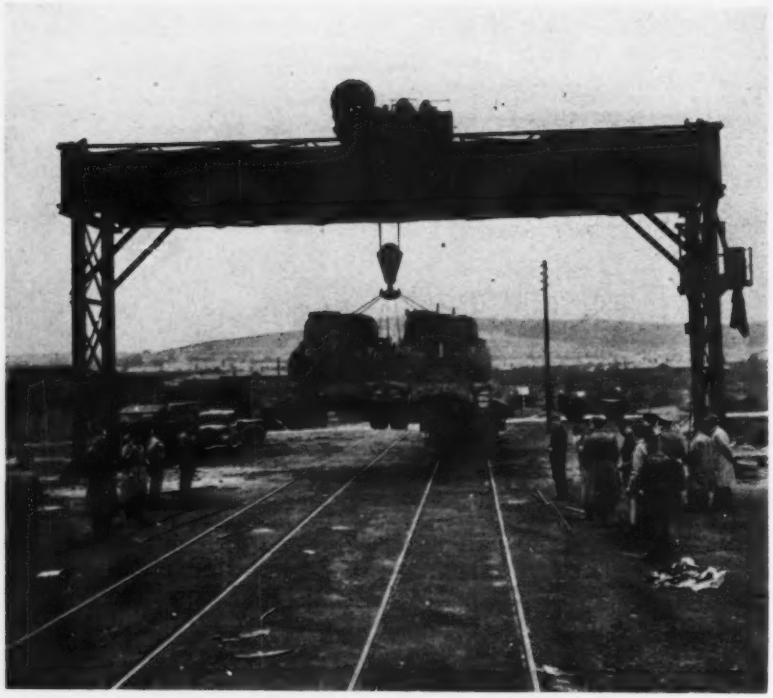
That lend-lease works both ways is evident in other engineer activities. All of our construction materials are contributed by the British, as has been mentioned before in these despatches. And to see how the contribution goes much farther, one has only to visit a U. S. Engineer depot, where "operational supplies", more vulgarly known as invasion materials, are being assembled. Next to a pile of American-made pierced-steel plank for airplane runways, will be a pile of British military bridge trusses. British Nissen and American Quonset huts are nested close together, row upon row. An American bulldozer is parked beside a British ponton lorry. One can drive for hours up and down the roads of one of these depots, never being sure whether what he is seeing is stamped "Made in Britain" or "Made in U.S.A.". The one thing that is certain is that it is all marked on some bill of lading "Destination Europe". And that it represents a tangible expression of Allied co-operation at its best.

These engineer depots will supply the materials for invasion. What about experience in their use and in construction techniques generally? Once a landing is made in Europe, every conceivable type of construction will be called for:—roads, bridges, airfields, oil, water and sewer lines, railroads, camps, warehouses and depots. The Germans will leave few facilities intact. Do the Engineer troop units have what it takes to build anything anywhere? This is an invasion question of first order importance.

The answer, a positive one, is to be found in the accomplishments chalked up by one general service regiment of engineers since it landed in England about a year ago. In that period it has built a five-acre industrial plant of mill-type buildings for an ordnance shop, installing all utilities including boilers, water supply, electric power and overhead cranes; an anti-tank range involving three miles of crazy quilt cut and fill and the tracks upon which the targets move; a 40-ton welded gantry crane; a camp and all the varied types of construction that are entailed; several gasoline and oil depots which required dozens of graded and rolled or paved hardstandings; a supply depot and all of its railway trackage; and an ammunition depot in which miles of cement stabilized roads were laid down. On one occasion the regiment constructed a runway in a farmer's field for the sole purpose of permitting a Flying Fortress, forced down by lack of fuel, to take off. And as sidelines, it has built an addition to a village school, repaired a town sewer system and constructed two flood control dams 8 ft. high and 500 ft. long. As yet, the boys haven't mined any coal, but they have pitched hay.

Anti-tank range

Several of these operations are worth description, both for their engineering interest and for the light that they throw on the kind of training that is turning ordinary American boys into experienced army engineers and construction men. The anti-tank range furnishes one example. The specifications were merely to build three different ranges—one straight and two with various twists and turns, hills and valleys in them. A track, upon which a car carrying a silhouette target of a tank could be run, was to be laid along each range, and an earthen embankment thrown up along one side to protect the car from shell fire. The embankment was to be about 20 ft. thick at the top and about 8 ft. high. It was a job for machines, and the regiments' dragline was called into service for the first time. When material had to be moved from cut to fill, tractor-hauled carrying scrapers were used. It could have been a simple exercise in equipment operation, but the rains came, and the clay at the site turned the job



Engineer-troop-built gantry crane of welded structural steel successfully undergoing a 150-percent overload test.

into a man-killer. The commanding officer swore and grumbled with the men, but he knew that it also rains on clay in Europe, and that this was the way to prepare for it. In all, some 48,000 cu. yd. of cut and 30,000 cu. yd. of fill were required, and three miles of railroad track had to be laid before the ranges were ready for the targets that will give the anti-tank gun crews their particular kind of invasion training.

Practice in soil stabilization

Stabilized soil roads are an invasion item that you can't order from a depot. But in England where most soils are difficult to stabilize, a lot of useful experience can be gained by attempting to develop techniques that will produce a usable road, regardless. By applying such a theory to the roadbuilding problem in an extensive ammunition depot, the regiment crowned its efforts with success, and introduced the troops to soil-stabilization practice and equipment.

The material encountered was a clay containing a medium amount of chalk, so that in gradation it was not unlike sandy-clay while the chalk was not present in sufficient amount to hinder cohesion with the cement. It contained about 17 percent moisture, about 4 percent less than was required for optimum compaction. A 6-in. thick base, 18 ft. wide, stabilized with 10 percent cement by weight was sought. To make the job of water application easy, it was figured out that one gallon of water per lineal foot of roadway would raise the moisture content of the material 1 percent.

The first operation was to run a disk plow over the subgrade throwing the material toward the centerline. This was followed by a disk harrow that spread it out ready for the addition of cement from sacks. Mixing was by rotary tillers, towed by tractors and followed by the disk harrows and the water-distributor trucks. Sheepsfoot rollers, also followed by disk harrows, were used for compaction, supplemented when necessary by a multi-wheel rubber-tired roller. During these operations the plows kept the ditches open, and after compaction was complete, final shaping of the surface was done with a motor-patrol grader followed by an 8-ton tandem roller. The surface was hard and firm and, when treated with a prime coat of tar sprinkled with basalt granite chips and covered with a tar seal coat, a road resulted that would warm a truck driver's heart even though his load might be block-buster bombs. And perhaps just as important, the troops learned about cement-stabilized roads.

The gasoline and oil storage depots presented a quite different problem. Here, separated areas or hardstandings, 50 or 60 ft. square, had to be leveled off and compacted to provide foundations for the stacks of drums. Each hardstanding was a little construction job in itself, requiring a tractor-hauled carrying scraper and a 1½-ton tandem roller of British make as the main items of equipment, but also entailing a lot of pick-and-shovel work. Only about 4 in. of gravel was actually required to carry the loads, but uneven terrain might require cuts and fills of 2 ft. or more. Small things in themselves, the hardstandings afforded experience in rough and speedy construction, where hard work and good organization are the principal elements for success.

But a general service regiment, if it is to live up to its name, must be more than a dirt moving outfit. It must be able to tackle anything. This one, as pointed out, built an ordnance shop, and it also constructed as neat a gantry crane as can be found in many a railroad yard at home. Such structures are also invasion items. Ordnance will have to be repaired, and tanks and other heavy equipment will have to be unloaded in Europe. It is not safe to count on the facilities being ready at hand.

The gantry crane came to the job as 17 tons of mill-length structural steel. Oxyacetylene cutting torches and arc welding electrodes comprised the fabricating equipment. There had to be fashioned a 40-ton capacity crane having a clear span of 52 ft. and vertical clearance of 23 ft. The elements were two 60-in. plate girders, each with a horizontal stiffening truss, supported on x-braced bents with 12-in. I-beam legs. The hoist to be carried weighed 10 tons. Fabrication and erection, exclusive of foundations, painting and installation of the hoist, were accomplished with 1,520 man-hours of labor. In a test, the crane carried a 56-ton load, consisting of two tanks, with a deflection of only ¼ in. at the centre of the span.

Finally, in addition to all of this training and experience, the troops are rumoured to have mastered the technique of "moonlight requisitioning", i.e., the science of acquiring needed equipment or materials without formality.

Bring on the invasion!

River Diverson at Shasta Dam

David C. May
Office Engineer, Pacific Constructors, Inc.

Contents in Brief—A conveniently removable cofferdam or gate, designed to be handled by the cableways, permitted two slots, left in the central portion of the dam, to serve alternately as channels for stream flow, while water level was raised in 10-ft. steps to diversion tunnel level.

MASTERY OF A RIVER such as the Sacramento at Shasta Dam, where the flow varies from a low of 3,000 cu.ft. per second in late summer months to a high in spring floods of 185,000 cfs., required considerable thought and ingenuity. This applies particularly to preparation for alternately transferring the flow from one low row of blocks or "slot" through the spillway section to another. By cofferdamming and placing concrete in each of the slots, alternately, while stream flow passed through the other, water level in the reservoir was raised, by 10-ft. steps, to a point where it could flow through the diversion tunnel under the right abutment of the dam.

Temporary closure difficulties

Swift water and projecting rock islands ruled out the possibility of using a barge and sinkable bulkheads; velocity and lack of suitable handling facilities eliminated an idea for gates of the "beartrap" variety (hinged leaves lowered into the water and allowed to slam against the concrete or frame). Another reason for rejecting these two types of closure was the difficulty they would involve in providing working space between the gate and the upstream face of the dam for building the forms.

Satisfactory gate requirements

Requirements that had to be met by a satisfactory gate were that it must:

1. Span an opening 52½ ft. wide;
2. Provide sufficient depth to place 20 ft. of concrete and still have enough freeboard to divert 8,000 cfs.;
3. Provide working space for form carpenters;
4. Be so constructed that it could be readily handled by the cableways;
5. Be strong enough to withstand overtopping during floods, and
6. Be watertight.

Of the three low rows of blocks in the spillway, two are 49 ft. wide and the width of the other is 52½ ft. When the gate was designed, it was thought that it might be necessary to use the widest row of blocks in the diversion program. However, later developments made it possible to use just the two narrower rows in the manner shown in the illustrations.

As concrete operations progressed in the high rows in the spillway section, anchor bolts were embedded in

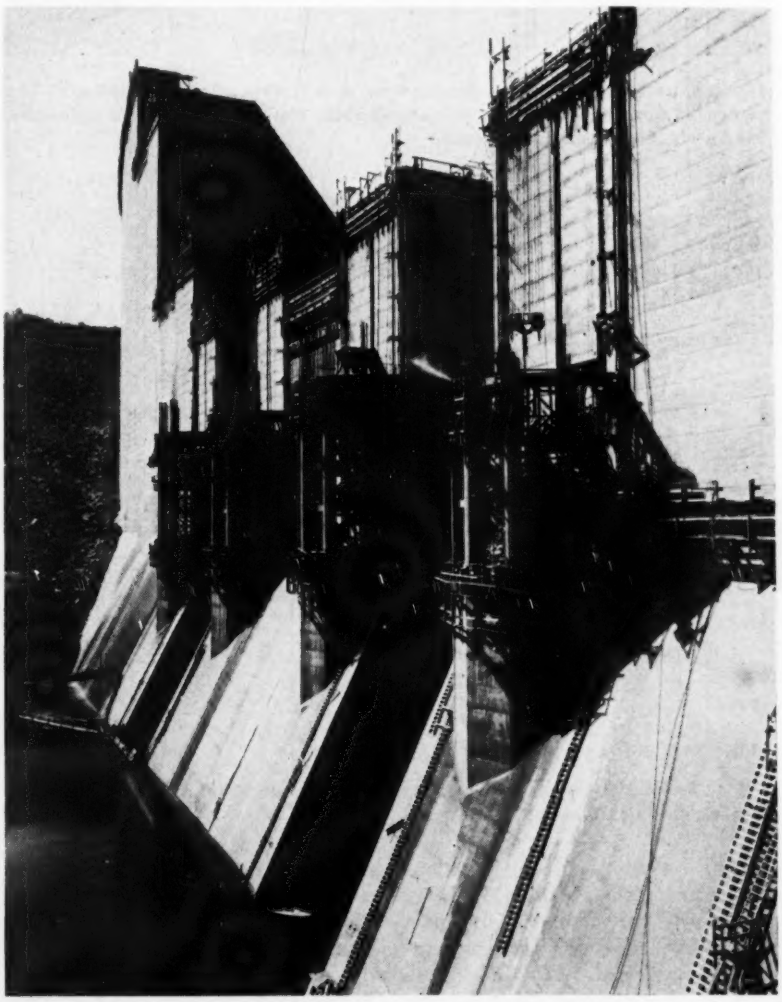


Fig. 1. Upstream face of Shasta Dam showing two slots used in the closure procedure. The cofferdam whose top appears across the slot in the background is used in the two slots alternately. Concreting in each slot is done, step at a time, for each position of the temporary cofferdam.

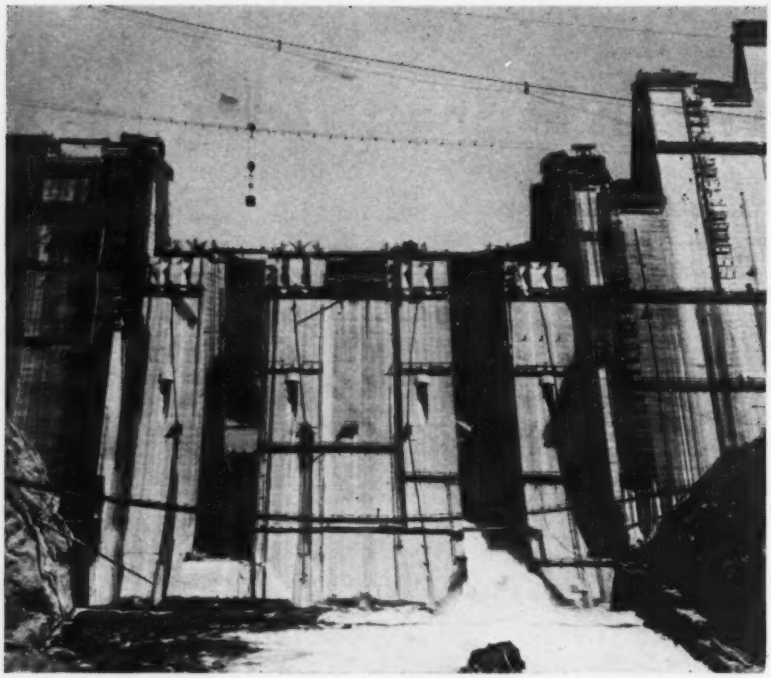


Fig. 2. Closure operations of Shasta Dam with a flow of about 6,900 cfs. The suspended bucket carries 8 cu. yds. of concrete. Workmen below it, in silhouette, are barely large enough to be seen.

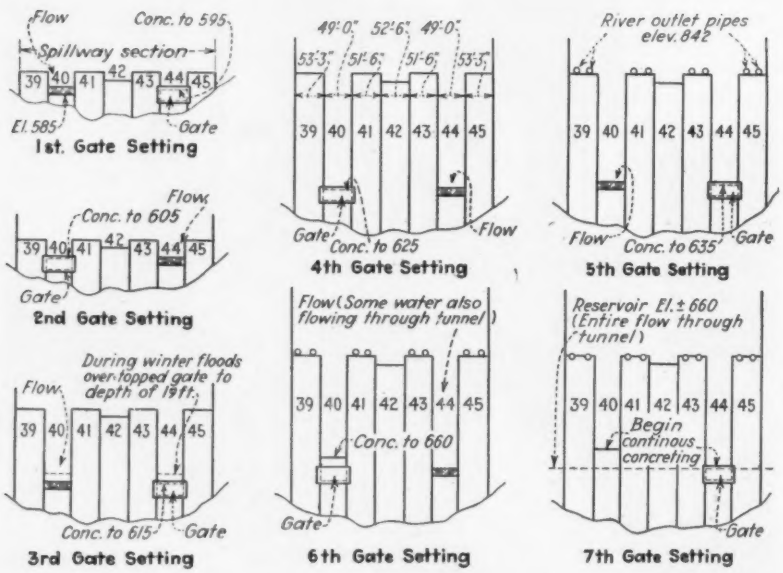


Fig. 3. Seven successive gate settings raised stored water until it could flow through diversion tunnel.

the concrete at the proper elevations to accommodate bearings or hinge seats by which to support the main gate frame. Two sets of these bearings are required.

When ready for a diversion, the bearings were brought out by the cableway and set in place on the anchor bolts. Placing of the gate frame, which weighs 42 tons, then required the services of two cableways combined, which removed the gate frame from its original position and transferred it to the new location. Lowered into position, and held horizontally, the bearing was secured and the cableway slings were released from the top of the gate. The cableway holding up the outer or bottom edge of the frame then lowered that edge into the water and on down until the bottom, as well as the sides, were in contact with the concrete of the dam. The cable sling was then securely tied off to the carrying beam for use in the next setting.

The five steel-bound timber gate leaves were next brought out on the cableway, one by one, lowered into position in the guides and wedged in place with the bottom end just above the water surface.

How gate was closed

Final closure was effected by pulling the leaves down one at a time by means of a system of blocks and cable terminating on the hoist drum of a tractor. The cableway stood by during this operation to carry top block and reeved lines to successive leaves. Final closure was made in as short a time as 30 min., but as the reservoir rose and thus involved a greater amount of storage per lift, more time in effecting closure was necessitated in order to maintain required flow in the river below the dam.

Two types of rubber seals used

The two types of rubber seals necessary for this type of gate were fabricated by the B. F. Goodrich Co. from existing molds. These seals (Fig. 4) have well withstood the necessarily rough treatment of terrific pressures and friction and have proved very satisfactory. The larger seal, Type 1, was designed to deflect or compress between $\frac{3}{4}$ in. and 1 in. at 12,000 lb. per lin. ft. of seal. The smaller seal, Type 2, has had to stand up under the friction developed under compression when being lowered into place in the slots in the main frame. Both seals are sufficiently reinforced with multiple-ply fabric.

Preparation of diversion channel

The story of river diversions at Shasta Dam is not complete without reference to steps that were necessary before concreting in the spillway section had risen to a level where the gate could be used. While the river was still in its original bed, a channel was excavated along the east bank in what is now the 39 row and a thin concrete wall with a maximum height of about 6 ft. was placed on top of the ridge of rock which was allowed to remain between the original streambed and the new channel.

A rock fill cofferdam was then placed in the original streambed about 100 ft. upstream from the dam, directing the flow through the new channel. This permitted completion of excavation and the placing of concrete in the 42, 43, 44 and 45 rows to a point where row 44, a low row, could be used as a channel. Then by removing the large rock cofferdam in the main river channel and placing a smaller one in the diversion channel, the flow was diverted to the 44 row permitting completion of excavation and the placing of concrete in the remainder of the spillway section to a point where the steel gate could be used.

Diversions with the gate were started late in the summer of 1942; were abandoned during the ensuing winter and spring floods and were resumed in May, 1943. Seven gate settings were required to raise the level of the reservoir from El. 587 to El. 655 or 660 (depending on the flow of the river at the final gate setting) to force the entire flow through the prepared diversion tunnel under the right abutment. The entire flow of the Sacramento River was passing through the tunnel on July 10.

Control of flow through tunnel

Final closure of the flow through the tunnel will be effected by two coaster gates located in 150-ft. shafts leading down through the rock into the tunnel. These gates will also control the flow to be released during the very important operation of filling the reservoir during the rainy season of 1943-1944.

The Shasta Dam and power plant project is being constructed under the direction of the United States Bureau of Reclamation by Pacific Constructors, Inc. Ralph Lowry is construction engineer for the Bureau of Reclamation; Francis T. Crowe is general superintendent, and W. V. Greeley is chief engineer for the contractor.

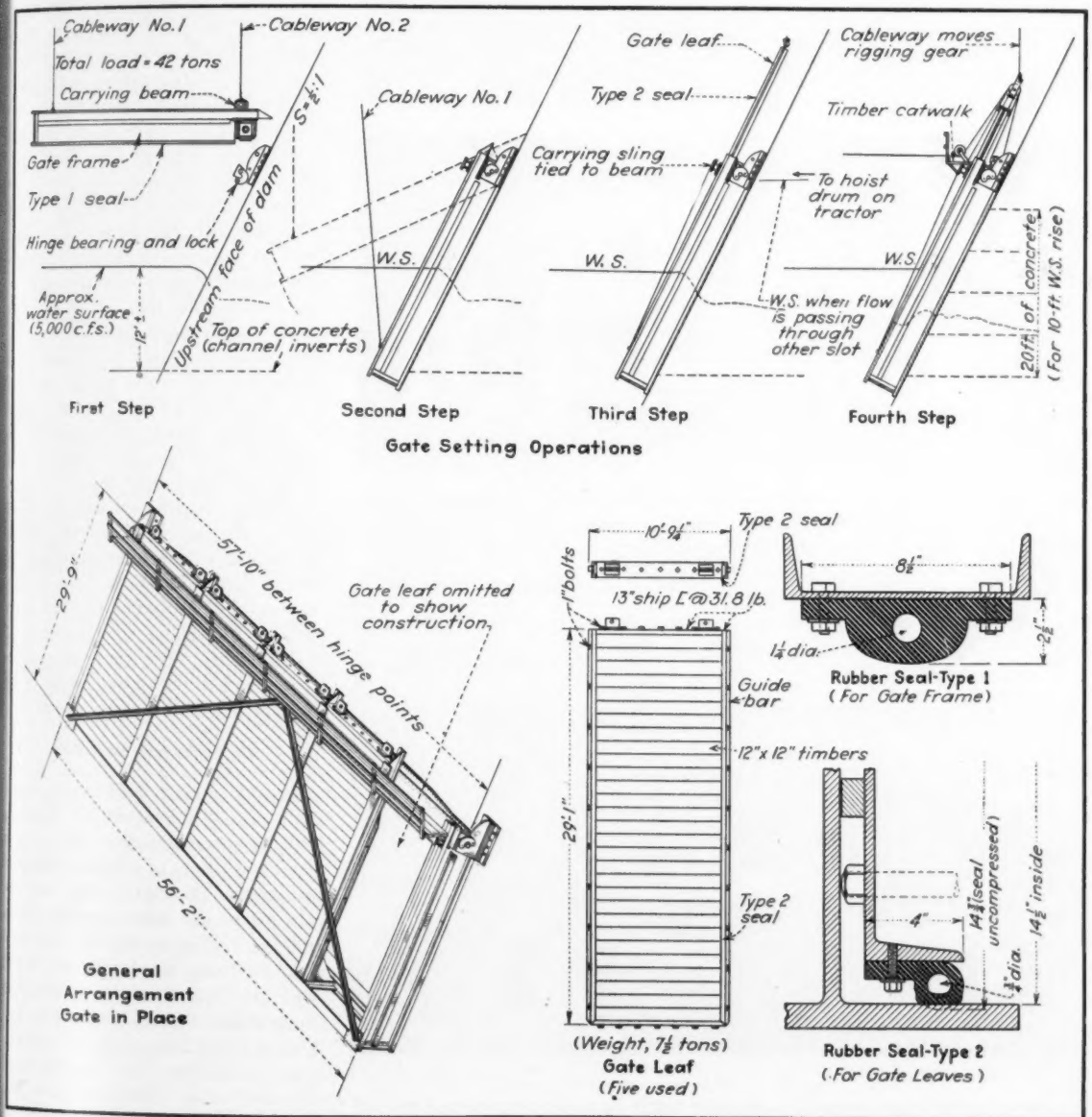


Fig. 4. Details of gate design and the process of effecting closure by sliding down five leaves, one at a time.

Unique Test Building for Army Equipment

***Contents in Brief**—An experimental laboratory building providing hot and cold rooms for testing mechanized equipment under conditions ranging from those of the tropics to the Arctic has been built for the U. S. Army Armored Force. The cold room, which has a separate air-conditioning system, has a 28-in. thick floor, 20-in. walls, and 20-in. ceiling, including 12 in. of cork all around. The walls of the hot room are of thinner construction and insulated witth mineral wool.*

RECENTLY COMPLETED at a Midwest army camp is a laboratory building that will permit the study of the effects on men and machines of the extreme weather conditions to be encountered in the U.S. Army's Armored Force operations throughout the world. Hot and cold rooms of sufficient size to accommodate a 60-ton tank are provided. The hot room is capable of producing temperatures up to 150-deg. F., in combination with humidities as high as 95 percent, thus simulating any condition to be found in desert or jungle warfare. Winter conditions can be simulated in the cold room, which has a range extending to 60 deg. F. below zero.

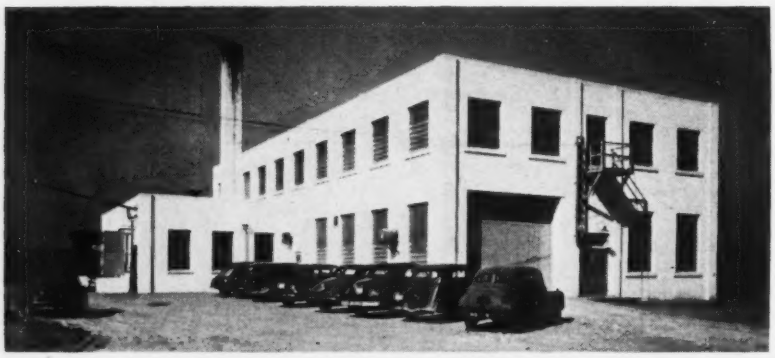


Fig. 1. Built to test military equipment under varied climatic conditions, this concrete-frame experimental building has concrete-block walls. Entrance to hot room is by big door at right. Utilities room is at left.

Fig. 2. Equipment to be tested in cold room enters by a 5-ton rollaway door. At right is the evaporative condenser for the cold room. This view shows the opposite end of the building from that shown in Fig. 1.

The laboratory is a 54 x 110-ft., two-story structure, with reinforced-concrete frame. It is air-conditioned throughout by means of a seven-zone, summer-and-winter system. The lower floor of the building is used for laboratories, while the offices, library and special study rooms occupy the upper floor. A 28 x 57-ft. one-story wing is used to house the heating, air-conditioning and refrigerating equipment.

All vibration-producing equipment in the utilities rooms is on isolated foundations. The ground floor, except for the hot and cold rooms, is a 4-in. reinforced concrete slab on a 6-in. sand fill. The second floor and the roof are beam-and-slab construction supported on girders at the exterior longitudinal wall and at the corridor, permitting rooms about 22 ft. wide along each side of the building.

The exterior walls of the laboratory building are a 12-in. thickness of concrete block with glass-block windows. All the partitions, except at the hot and cold rooms, are of wood stud construction with plywood facing. The partitions are framed to the bottom of the finished ceiling to permit future rearrangement of the laboratory space with the least difficulty. Throughout the laboratory, corridors and office space, the ceiling is suspended perforated metal with mineral wool fill and acoustical tile.

Big tanks may be tested

The 31 x 19-ft. cold room, which has a ceiling height of 14 ft. 2 in., is built to accommodate a 60-ton tank or several pieces of smaller motorized equipment. Structural walls of the cold room are filled concrete block and the ceiling is an 8-in. concrete slab, all being lined with 12 in. of cork and ½-in. of cement plaster. The finished floor is a 12-in. concrete slab floating on 12-in. of cork over an 8-in. foundation slab. An open-joint tile drain was installed under the foundation slab to provide ventilation, which prevents accumulation of frost

under the floor during periods of sustained low temperatures in the room.

The outside door opening to the cold room measures 15 ft. wide by 13 ft. high. An interior door opening and vestibule 3 ft. 6 in. by 6 ft. 6 in. on the building corridor side is also available. The 10-in. thick exterior door is metal clad and packed with glass wool. It is mounted on hangers and track and is provided with a sealing device. The corridor door is filled with 8 in. of cork and is a typical standard cold room superfreezer door vestibule arrangement.

Four 12 x 18-in. air-sealed, multiple-pane observation windows are provided at convenient locations in the walls of the cold room for observing the equipment under test. Each window contains eight-panes with silica gel-filled tubes in between to dehydrate the entrapped air and prevent frosting.

The refrigeration plant for the cold room is built to hold the enclosure at a temperature of 30 deg. F. below zero with 1,000 cfm. of air entering and leaving the room and with the motorized equipment within the room giving off about 600,000 B.t.u. of sensible heat hourly. The refrigeration plant is further capable of holding a temperature of 60 deg. below zero with a heat source of about 200,000 B.t.u. per hr. within the room. Fully automatic controls are provided to hold the room at maximum or intermediate load conditions. The cold diffusing unit and coils are 6-ft. deep and occupy the full width and height of the room at the end opposite the exterior door.

The refrigeration machinery is located in the utility room in the part adjacent to the cold room wall. The refrigeration system is a two-stage, ammonia type using a vertical, double-acting compressor on the first stage and a vertical, single-acting compressor on the second stage. Each compressor is V-belt driven by an electric motor. An intercooler is used between compressors and an evaporative condenser is located outside the cold room just above ground level.

The cold diffusing unit consists of horizontal steel coils with blowers above and an air intake at the floor level. The diffuser circulates 39,000 cu.ft. of air a minute, blanketing the whole room with a stream of chilled air.

Replacement air entering the cold room is obtained through an intake

Fig. 3. Loss of air from the cold room is reduced by a vestibule into which workers step before opening the inner door. To the right of the door is one of four observation windows.

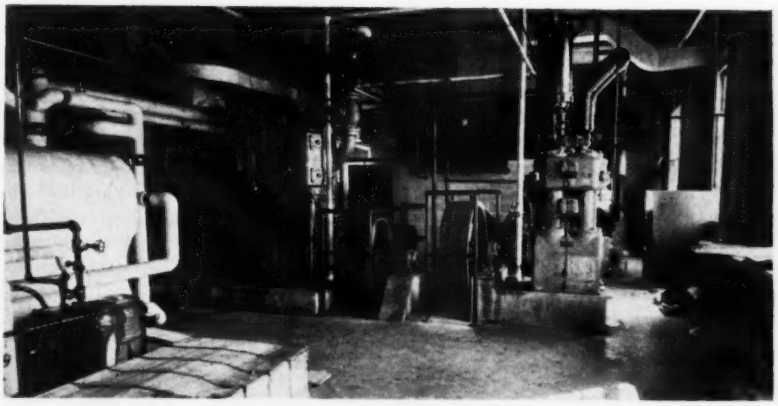


Fig. 4. Cold room refrigeration equipment consists of the 9x9-in. first-stage compressor at right and the 10½x8-in., low-side compressor in the center. At left is boiler for heating hot room and remainder of building.

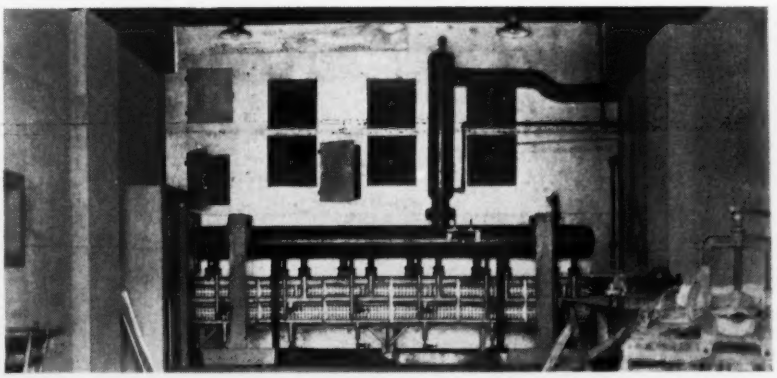


Fig. 5. Refrigeration equipment inside the cold room consists of heat exchanger (black vertical tube), surge drum (horizontal black tube) and twelve-row coil banks. The six openings above the equipment are outlets from squirrel-cage blowers operated by two 7½ hp. motors.

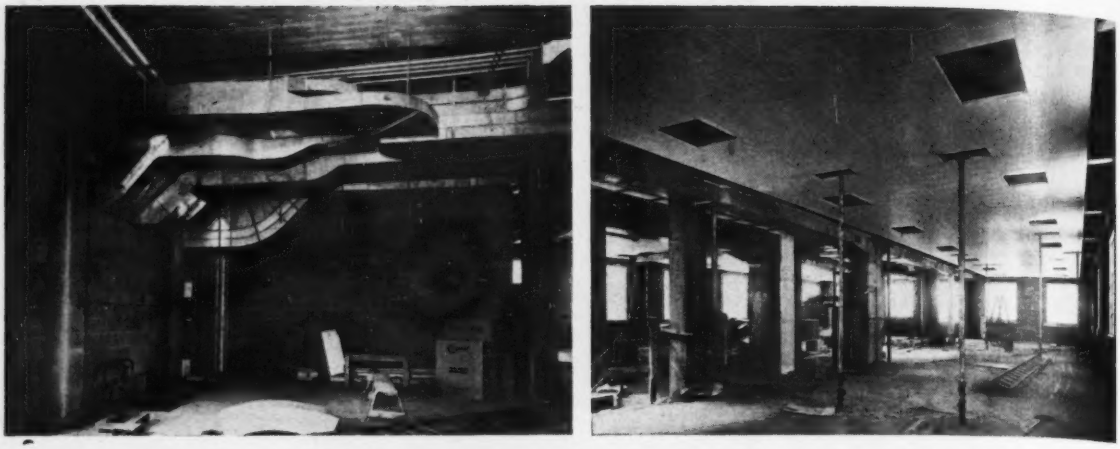


Fig. 6. From utilities room a fresh airduct leads to each of the seven air conditioning zones into which the building is divided. Later these ducts were boxed in. At the right is shown the floor before the partitions were built. Fresh air ducts are by the columns in what will be the corridor wall.

on the roof of the utility room. After is passes through a cooling coil, where it is chilled to about 40 deg., the air passes through a gas-fired, silica-gel, drum-type dehumidifier and is introduced into the cold room behind the cold diffuser unit as dry air at about 70 deg. F.

An exhaust fan is located near the ceiling and a duct from the fan extends to the roof of the adjacent utilities room. The exhaust fan unit is provided with a cork-filled door for accurate control.

Construction of hot room

The hot room and appurtenant equipment is designed to produce a maximum temperature of 150 deg. F. at 95 percent humidity with 700 cfm. of air being added to the room. The clear space in the hot room is about the same as in the cold room. Adjacent to one end is an observation room, and in the common wall there is a door and a large observation window.

The hot room floor consists of a 12-in. concrete slab on 6-in. sand fill. The exterior walls and ceiling are furred with 2 x 4-in. studs and the interior walls are 2 x 6-in. wood studs. Between the studs and the furring is a mineral wool bat insulation and over the furring a 1-in. T & G sheathing, 50-lb. roofing felt, and $\frac{3}{16}$-in. cement-asbestos board. The joints in the cement-asbestos board are covered with felt and cement-asbestos battens to provide a vapor proof lining. The roof is an 8-in. concrete slab.

Equipment to be tested in the hot room enters through a 14 x 16-ft. exterior door. The door is of wood roll-up construction and is insulated with glass fiber and sealed from vapor.

The heating and humidification machinery for the hot room is operated from the building heating boiler in the utilities room. Within the hot room, mounted near the ceiling at one end, is the heating unit. It consists of two steam coils, humidification valves, and a blower. The arrangement permits the room intake air to pass through or bypass the heating and humidification elements. As in the cold room, automatic controls are provided to maintain the room conditions once the desired temperature and humidity has been selected for the test run.

Construction of the laboratory was by the Louisville District, U. S. Engineers, Col. Henry Hutchings, then district engineer. Construction was supervised by Maj. Harold W. Lieske, area engineer. General Contractors were the Blauner Construction Co., Chicago, Ill., Steve Ertl, Jr., superintendent. The project, including equipment, cost about $300,000 and required about seven months for completion.

Survey Shows Indiana Highways Need Widening

More than 60 percent of the mileage in Indiana's state highway system has a roadway width less than 20 ft., according to a recent report by the Highway Planning Survey. This was pointed out by S. C. Hadden, chairman of the Indiana State Highway Commission, in calling attention to the need for continuing a statewide construction program.

According to the report, there now are 6,334 of the 10,202 miles of roads in the state highway system that have roadways less than 20 ft. in width. When the 2,359 miles of state highways having roadways of 20 to 21 ft. in width is included, then 87 percent of the mileage on the state highway system has a roadway width less than 22 ft. which is considered as the minimum width for two-lane pavement from the standpoint of modern design for safety.

Widening and improvement of a considerable part of this mileage has been included in the postwar highway construction program, to be inaugurated when funds, materials and men are again available. On the basis of normal construction costs, said Hadden, replacement of this 3,700 miles of state highways with new high-type construction, would require an annual expenditure of $43,500,000 over a ten-year period. However, it is estimated that the modernization can be effected at considerably less than this figure due to the fact that existing surfaces can be widened and improved without completely rebuilding the entire mileage. This work is put first on the postwar program.

Building Foundations on Compacted Fill

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***Contents in Brief**—To eliminate the need for carrying column footings at varying depths to firm soil and to insure no settlement of an ordnance plant floor under heavy loads, the poor soil was removed and replaced with compacted fill to carry shallow footings and the floor slab. Success of the operation was based on laboratory control of the compaction work after complete analysis of fill material.*

REPLACING SOFT MATERIAL and leveling up uneven ground with carefully-controlled compacted fill to carry shallow column footings and a concrete floor was a new method of foundation construction developed for a large building at a northwestern ordnance plant. This is but another example of meeting the peculiar conditions of war construction work that have taxed the resourcefulness of architects, engineers and contractors throughout the country. Inventions and new methods that save time and critical materials are becoming common on war work and, when considered as a whole, signify a great advancement in engineering and construction technique.

The plant includes a great many buildings scattered over a large area of rolling farm land; one part of the area is a hill more than 100 ft. high. The problem of adjusting the larger buildings to the contours of the land was a complex one, for railroad and highway grades, and sanitary and storm sewer levels had to be considered in the light of the cost of buildings at various floor elevations.

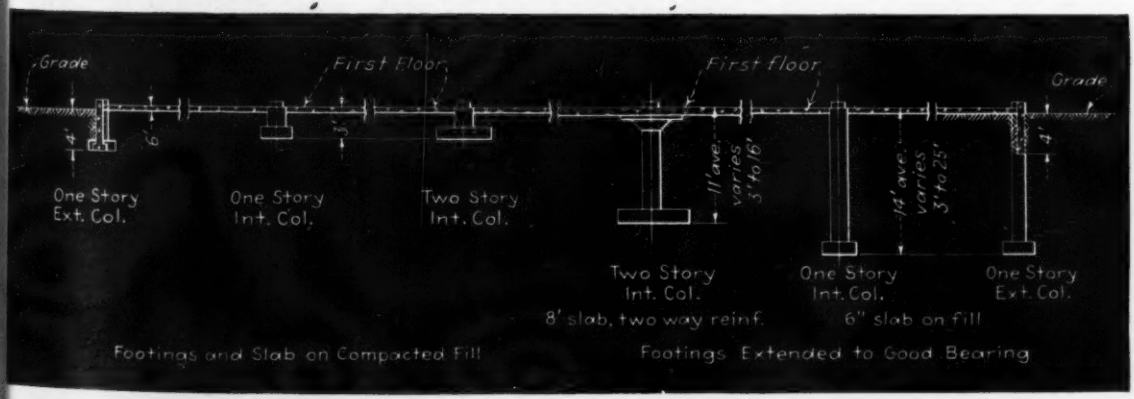
In one of the large buildings a part of the first floor is 10 ft. below and other parts are 25 ft. above natural grade. Several low, swampy potholes filled with 5 to 10 ft. of muck, dotted the foundation site. A part of the area was also covered with 5 to 10 ft. of frozen earth from last winter's operations. Except for the potholes, which are underlaid with solid material, the glacial drift is good for a bearing load of about 2 tons per sq. ft.

This is a one-story mill-type timber building with wood walls, columns and roof, high enough for a balcony, with no basement. The concrete first floor, level throughout, supports numerous precision machines interconnected with a maze of steam, gas, hot and cold water piping, electrical connections, conveyors, and spouting. While the machinery load is not heavy, metal stock surrounding the machines may result in extremely heavy loads. A settlement of this floor relative to the building columns and balcony floor, or uneven settlement of the floor itself, would cause serious interference with the continuous operation of the plant. For this reason it would be good practice to make the first floor self-supporting over a large part of the building, and carried on foundations down to firm natural soil. Serious consideration was given to such a design as shown in the accompanying illustration. However, the foundation piers would vary in height up to 25 ft.

To avoid this expense, the compacted fill method, also shown in the accompanying drawing was developed. As far as the author knows, this scheme has never been used for a building of this size and importance.

Compacted fill procedure

First, all soft material was removed from the potholes and frozen spoil bank, and waste from site grading and railroad and highway cuts was deposited in the low areas, thus leveling off the site. This material, mixed to as nearly a uniform composition as possible, was compacted sufficiently to carry a predetermined,



Comparative sections of shallow footings and slab carried on compacted fill (left) and alternate design of deep footings extending to firm soil.

superimposed load with a definitely known settlement. The building foundations were then placed upon this leveled site in the same manner as they would be in virgin soil.

Most important was the determination of the engineering characteristics of the compacted fill. The building foundations were designed to distribute a load of 2,000 lb. per sq. ft. on the soil, so the fill was compacted to safely carry this load.

A field laboratory was established, in charge of a trained testing engineer with the duty to select the fill material and to see that the soil compaction resulted in a uniform bearing value throughout the area.

The original subgrade soil was glacial drift, composed of sand, clay and gravel, varying throughout the site, but in its undisturbed state good for 3,000 to 4,000 lb. per sq. ft. There were a few wet spots of peat, muck and blue clay, removed before the soil compaction was started. Ground from which the fill material was obtained included a thin top soil, about 4 ft. of tan clay loam, some 10 ft. of red sandy loam varying from light to heavy, overlaying a layer of sand and gravel. In a few local spots were layers of fine sand.

Prior to start of filling a complete soil survey was made of possible sources of fill, and laboratory tests established the properties of the various soils, the moisture content at which they should be compacted, and the densities to be obtained. Properties of the two primary soils are shown in Table I.

As the soil was placed in the fill its moisture was carefully controlled. If too wet in the borrow pit, the soil was allowed to dry before being used. If the soil was too dry, water was sprinkled on the borrow pit. The moisture content was determined by standard Proctor equipment by penetration of the soil packed in the Proctor mold. A penetration of 200 to 300 lb. per sq. in. indicated the proper moisture.

It was not possible to compact each type of soil separately, so the fill was a mixture of tan clay and red sandy loam with some fine sand. This variation in soil did not make the determination of the moisture difficult, for, using the penetration method, the optimum for each class of soil occurred at the same penetration.

The soil was compacted with sheepsfoot rollers, trucks and trailer wagons and crawler tractors. Frequent tests were made to determine the efficiency of compaction. Density tests were made by cutting 5-in. dia. samples 5 in. deep from the fill, measuring the volume of the hole by the sand method, and determining the dry weight of the soil taken from the hole. The moisture content of the sample was accurately determined by drying. The theoretical density of the soil was determined by packing the samples in the Proctor mold at varying moisture contents to determine the optimum moisture content. Densities of the fill varied from 109 to 124 lb. per cu. ft. and from 90 to 100 percent of the Proctor density. The average density was 97 percent.

Compaction work, carried on from July 7 to Aug. 20, 1942, was delayed and handicapped by heavy rains. During that period there were seven storms, totaling 5.29 in. of rainfall, and causing a loss of time of 13½ days. The approximate time required to dry out the material was two days after each rain. All equipment was kept off of the compacted fill and the borrow pits until the surface started to dry. As soon as equipment could be worked, sheepsfoot rollers, discs and motor patrols broke up the surface of the compacted area to speed up drying. The total time required to complete the fill was 45½ days of 16 hr. each, two shifts per day.

Material was hauled in 12-yd. scrapers, and spread in layers about 3 in. thick. Bulldozers then smoothed up the surface of each layer, followed by sheepsfoot rollers making three or four passes if time permitted. Only six sheepsfoot rollers were available, more should have been used. Next, the tractors compacted the loose surface left by the sheepsfoot rollers. Following these, trailer wagons made endless rounds, until compaction was deemed completed. Then a motor patrol lightly bladed the surface to cut down the small ridges left by the trailer tires, and the area was ready for the next layer to be applied.

An average day's equipment was 16 12-yd. scrapers with 3 push tractors, 9 bulldozers, 6 tractors with sheepsfoot rollers, six 12-yd. trailer and dump trucks, three motor patrols and 4 tractors, one with a stone boat. On each shift was one general foreman, four foremen or dump men, and ten laborers besides the truck and tractor drivers. All except one tractor used for rolling weighed 17 tons, and the trailer wagons weighed 10 tons.

Occasionally a sprinkler truck had to be used when the material became too dry. Sometimes the pit was sprinkled or the fill was sprinkled, depending upon the condition of each place. Discs were only used after rains, to dry the surface.

If rain appeared imminent, every effort was made to get the surface compacted. Scrapers and sheepsfoot rollers were stopped and the tractors and scrapers were speeded up to the freshly-laid layers so they would absorb less water. Compacted areas were always dry 4 or 5 hr. sooner than uncompacted layers after a rain.

At first careful direction was required until the drivers became acquainted with the compaction work, then the operation became almost automatic. With all of this heavy equipment circulating around in this relatively small area, there was only one accident, indicating reasonably efficient organization of the work.

The amount of compaction was regulated according to the laboratory tests. Density and moisture tests were made several times a day, particularly on hot, windy days when the moisture content had to be watched with more than usual care.

That the methods adopted are practical, and that a fill of fairly uniform density and bearing value was obtained, is shown by the soil bearing tests which were run as each part of the area was completed. Some 13 tests were run as shown in Table II. At a load of 2,500 lb. per sq. ft. (500 lb. in excess of the working load), the maximum deflection found is about ⅛ in. This is probably less than would be found for 13 tests of the natural

TABLE I—PROPERTIES OF TWO MAIN AVAILABLE SOILS

	Tan Clay Loam	Red Sandy Loam
Mechanical Analysis:		
Gravel, on No. 10 (pct.)	5	12
Sand, 10–270 (pct.)	46	45
Silt, 270 to .005 mm (pct.)	26	25
Clay, .005 mm down (pct.)	23	18
Soil Constants:		
Liquid limit	40	20
Plastic limit	16	12
Plasticity index	24	8
Centrifuge moisture equivalent	11	17
Field moisture equivalent	26	16
Shrinkage limit	9	9
Classification:		
Textural	Clay loam	Sandy loam
Bureau of Public Roads	A-6	A-2
Data for Compaction:		
Optimum moisture (pct.)	16	10.5
Optimum density (lb./cu. ft.)	108	128
Penetration at optimum (lb. per sq. in.)	300	200

TABLE II—SETTLEMENT IN INCHES FOR LOADING TESTS

Loading Lb./sq. ft.	2,500	5,000	7,500	10,000	12,500	15,000	17,500	20,000
Test 1	.08	.25	.87					
2	.04	.44	.78					
3	.04	.23						
4	.00	.36						
5	.12	.68						
7	.10	.61						
8	.01	.26						
9	.01	.32	.48	.75	.91	1.36	1.74	2.55
10	.10	.49						
11	.10	.56						
12	.00	.15						
13	.00	.24						

Area of bearing plate 2¼ sq. ft. except test No. 9, where bearing plate was 1 sq. ft. in area.

TABLE III—COST COMPARISON, COMPACTED FILL AND SUPPORTED SLAB

Item	Compacted Fill Quan.	Compacted Fill Cost*	Piers Supporting 460 Slab Bays Quan.	Piers Supporting 460 Slab Bays Cost*
Excav., General	132,683 c.y.	$59,707	131,818 c.y.	$79,090
Hand	4,272 c.y.	7,092	1,700 c.y.	1,700
Backfill, Borrow	91,270 c.y.	49,830	91,270 c.y.	63,889
Material on site	108,730 c.y.	19,680	108,730 c.y.	43,492
Footings, Forms	.....	.....	33,800 s.f.	10,149
Concrete	1,424 c.y.	16,234	1,670 c.y.	19,038
Rein.	10 ton	1,070	66 ton	7,062
Piers, Forms	13,450 s.f.	4,035	100,120 s.f.	40,048
Concrete	307 c.y.	3,500	1,665 c.y.	19,081
Rein.	½ ton	54	81 ton	8,667
Walls, Forms	50,140 s.f.	17,048	59,800 s.f.	20,332
Concrete	899 c.y.	10,249	990 c.y.	11,286
Rein.	2½ ton	268	33 ton	3,531
Slab, Concrete	7,180 c.y.	81,852	8,410 c.y.	95,874
Rein.	160 ton	17,120	297 ton	31,779
Support under floor piping	.....	.....		4,560
Total Cost		$287,742		$459,569
				287,742
Total saving using compacted fill method				$171,827

* Labor and material costs only, no overhead or profit included.

soil. The tests probably indicate that 3,000 lb. per sq. ft. might safely have been used in the building design. It will be noted that at 5,000 lb. per sq. ft. the maximum settlement is 0.68 in.

The cost of excavating the earth, placing and compacting the fill, exclusive of overhead charges, was as follows:

Amount of earth moved, 200,000 cu. yd.

	Total	Cost per Cu. Yd.
Excavation and haul,		
Equipment	$36,642.33	$0.197
Labor	7,848.28	.043
Total	44,490.61	.222
Compacting,		
Equipment	42,368.52	.228
Labor	22,385.13	.121
	64,753.65	0.324
Total Cost	$109,244.26	$0.546

It will be noted that the actual cost of compaction, including labor and equipment rental is $0.32 per cu. yd. This expense was justified in this case by the saving in critical materials used. Referring to the two designs shown in the drawing, the footings and floor on compacted fill results in a saving of 304 tons of reinforcing steel, 2,925 cu. yd. of concrete, and 140,000 sq. ft. of form lumber.

Another advantage in the design selected is that 16,700 lin. ft. of sewer and water pipe under the first floor could be laid on solid ground, close under the floor. If loose fill had been used there would have been danger of opening joints from settlement. Where a self-supporting floor was contemplated it might have been necessary to support pipes on steel hangers, thus using additional critical materials.

Whether the compaction method is practicable under normal conditions will be largely determined by comparative costs. For smaller jobs, other methods of compacting may be used, such as air tampers. The key to successful compaction lies in complete laboratory control, a knowledge of the characteristics of the material and a determination of the actual compaction and resulting bearing capacity of the fill.

Cost estimates on this job show the compacted fill method was $172,000 cheaper than a design of deep piers and supported slab. The comparative estimates are shown in Table III. This saving, amounting to 37 percent, indicates the compaction method is warranted in similar cases where equipment is available.

The plant was built under the direction of the U. S. Engineers, Col. J. W. Moreland was district engineer; Major Lynn C. Barnes was area engineer. The architect-engineer for the project was Smith, Hinchman & Grylls, Inc., Detroit, Mich., and Toltz, King & Day, Inc., St. Paul, represented on the job by P. J. Ketelhut, project administrator. The combined firm of Foley Bros. Inc., St. Paul, and Walbridge-Aldinger Company of Detroit, were general contractors. The field laboratory and testing were in charge of the Twin City Testing & Engineering Laboratory, St. Paul. Earth compaction was in charge of R. R. Blase representing the architect-engineer.

Accurate Paving Required for Blimp Bases

The Navy calls them L.T.A. stations but the layman translates this into lighter-than-air bases for blimps on coastal patrol. These stations have sprung up all along the United States shoreline and each of them have one or more circular paved areas which are to the blimps what runways are to the airplane.

As the circles are large, usually 2,000 ft. in diameter, they present a nice drainage problem because grade changes are undesirable and it is customary to grade in one direction entirely across the circle. The slope is usually 0.4 percent or a total of 8 ft. for the 2,000 ft. On the opposite diameter the slope is made 6 in. for the 2,000 ft.

For requirements of this sort the necessary accuracy in leveling is far beyond that used in setting grade stakes for the average highway contract. The secret of success in getting satisfactory drainage, according to the engineer in charge of one of these jobs, is to start the special care with the foundation. Make sure of extremely thorough compaction of the subgrade and then see that base material is well rolled and surfaced to within less than half an inch of specified grade at all points. Then the black top surfacing job, done with the high degree of accuracy required, can be expected to "stay put."

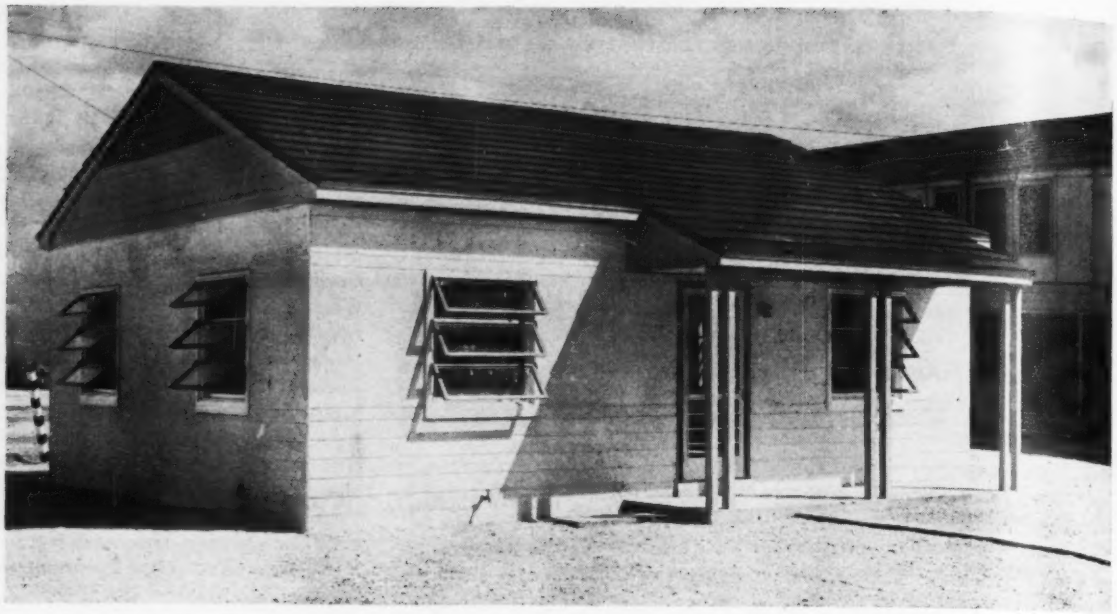


Fig. 1. Prestressed reinforcing steel was used in 2½-in. thick concrete walls of this U. S. Maritime Commission house.

Electric Prestressing of Reinforcing Steel Used for Small House Construction

K. P. Billner,
President, Vacuum Concrete Inc., Philadelphia, Pa.

***Contents in Brief**—Prestressed reinforcing for concrete has gone a step further in experiments with electric heating for expansion recently conducted on thin walls for concrete houses. Bars threaded at each end are coated with a thermoplastic material and placed in the usual manner. After the concrete has hardened, low voltage current is passed through the reinforcing bars to heat them to about 250 deg. F. above the temperature of the surrounding material and the nuts on threaded ends are taken up a computed amount. Cooling of thermoplastic restores the concrete bond.*

PRESTRESSING of smooth reinforcing rods in concrete by temporarily lengthening them by passage of low voltage electric current has been successfully accomplished in concrete house construction. Rods are coated with a thermoplastic material that is melted by the heat, temporarily relieving the bond, while the rods elongate through the concrete. The elongation is taken up a predetermined amount by nuts on threaded ends of the rods and cooling is then permitted. The thermoplastic used must be one that solidifies on cooling and restores the bond; sulphur was used on the experimental houses. Some low-melting-point alloys also have been found to be satisfactory.

Without prestressing of the reinforcing it is not possible to utilize in full the potential strength of either steel or concrete. Prestressing has the added advantage of eliminating cracks due to shrinkage and increases greatly the resistance to shear. The electric method of prestressing used delays construction very little and, because of almost instantaneous heating of the rods, does not warm the concrete appreciably.

Prestressing of reinforcing has recently been experimentally used in construction of two concrete houses built for the U. S. Maritime Commission's Maritime Housing Project at Tampa, Fla. The houses are one-story, two-bedroom units about 25x30 ft. Walls are only 2½ in. thick and have shallow horizontal grooves cast in the face for architectural effect.

Only the walls have prestressed reinforcing and these were precast on the concrete floor of the house, two at a time. Canvas was stretched on the ground floor and edge forms made of 2½x2½-in. angle iron defining the shape of the walls were placed on the canvas. Frames for door and window openings were placed in the same manner.

The reinforcement, which consisted of ⅜-in. smooth-round, sulphur-coated rods, was put in place and adjusted so that the rods would be in the center of the wall thickness. Six rods were used in the longitudinal direction and nine or thirteen transversely for the 25-ft. and 30-ft. walls respectively.

These rods amounted to only 400 lb. of reinforcement for each house.

Ordinary reinforcing steel with a yield point of 40,000 psi. was used and the bars were prestressed to 35,000 psi. If a harder grade steel, say of 75,000 psi, yield point, had been available then the prestressing could have been carried up to 50,000 psi., and ¼ in. rods used, cutting in half the quantity of reinforcing steel required.

Coating the rods was done by placing them in a long, narrow trough made of 20-gage galvanized iron and filled with sulphur. Electric current was applied to this trough for heating and the rods were lifted out as soon as the sulphur melted. Rods were then put in place in the forms.

Concreting was done in two operations. A bottom layer of 1 part white cement and 2 parts sand was spread to a thickness of ½ in. on the canvas. On this was poured a 2-in. layer of 1:2:3 concrete, using ordinary Portland cement and ⅝-in. gravel. This was placed before the bottom layer had set to assure a monolithic structure. The concrete was vacuum-processed on the side that becomes the inside of the wall to expedite hardening and increase the strength.

Both the longitudinal and transverse reinforcing rods had threaded ends protruding outside of the concrete. A nut and heavy washer was put on each end of the rods after the edge forms had been removed.

The amount of "take-up" on the nuts required during the elastic elongation of the steel by heating is the length of the specimen multiplied by the sum of three factors: (1) The desired tension strain in the steel; (2) The compressive strain in the concrete; and (3) The coefficient of anticipated shrinkage in the concrete.

Therefore the "take-up"

$$t = L\left(\frac{f_s}{E_s} + \frac{f_c}{E_c} + C\right)$$

The total tension in the steel is counteracted by a corresponding compression in the concrete. Therefore if;

f_s = desired tension in the steel
a = total area of reinforcing steel
f_c = compressive stress in the concrete
A = concrete area
$a = f_c A$, and therefore
$= \frac{f_s a}{A} = f_s p$ in which p is the percentage of reinforcement

The final form of the formula is then:

"Take-up" $t = L\left(\frac{f_s}{E_s} + \frac{f_s p}{E_c} + C\right)$

in which,

L is the length of the specimen

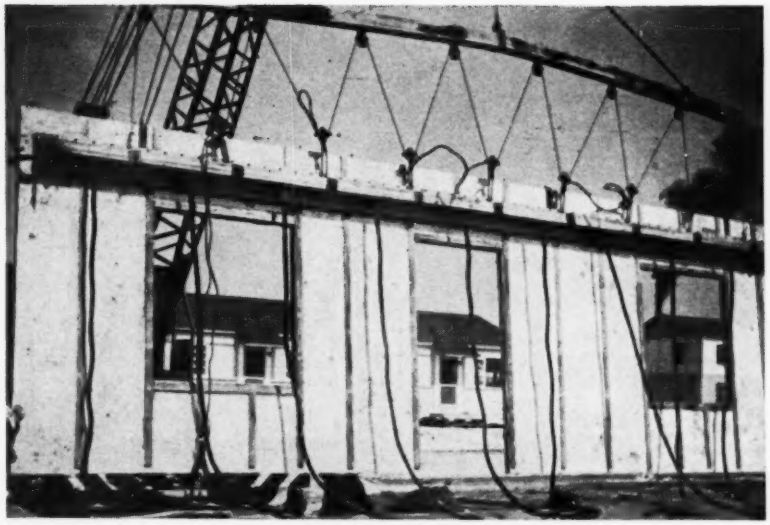


Fig. 2. Concrete wall sections were lifted by an equalizer attached to a T-beam containing a series of vacuum cups. These cups made attachment to the flat surface almost instantaneous.

E_s is the modulus of elasticity of steel (assumed at 30,000,000)
f_s is 35,000 psi.
p is taken as 0.16 percent
E_c is the "sustained modulus" of elasticity of the concrete, assumed at 1,500,000
C is the coefficient of anticipated shrinkage, assumed to be 0.0005 for these thin slabs.

(A report to the American Concrete Institute shows the shrinkage coefficient to vary from 0.00015 to 0.00045 depending on the mass of the specimen. However, for very thin slabs it has been found to be as high as 0.0006 and for a 2½-in. thick slab to be about 0.0005.)

The "take-up" for 1 ft. (12-in.) of rod is

$$t = 12\left(\frac{35{,}000}{30{,}000{,}000} + \frac{35.000 \times 0.0016}{1{,}500{,}000} + 0.0005\right) = 0.020 \text{ in.}$$

The "take-up" for the 30-ft. rods would then be 0.6 (⅝ in.) and for the 9 ft. 6 in. long transverse rod, 0.2 in. This produces a tension of 3,800 lb. in each ⅝ in. dia. rod.

The heat, above that of atmospheric temperature, required to produce this elongation is constant for any length of rod. It is merely the elongation desired divided by the coefficient of thermal expansion. Required heat then is

$$T = \frac{.020}{.0000067 \times 12} = 250 \text{ deg. F.}$$

This is not enough heat to result in color change, undue warming of the concrete or to cause any difficulty in turning up the nuts.

The heating medium found best for the rods is high-amperage, low-voltage, alternating current, 500 amp. at 30 volts being used. No insulation or other precautions are necessary when handling 30 volts regardless of amperage. The rods may be touched, even if wet, without perceptible shock so that ordinary wrenches may be used for taking up the nuts.

On the experimental houses just completed the prestressing was done shortly before the walls were lifted into position. Current was taken from an a.c. feeder line and passed through a transformer mounted on a truck. Threaded copper electrodes were screwed to each end of each rod, the time required to heat and elongate each rod, including affixing and releasing the electrodes, being about 30 seconds.

Walls were lifted from the casting bed and set in place by a crawler crane, sometimes when the concrete was only four days old. The walls were "grabbed" by an equalizing beam lifting through a vacuum attachment to the concrete. A long "T" beam, the bottom flange of which was built up of plywood, had the face in contact with the wall divided into nine separate compartments, with soft rubber gaskets around the edges of each compartment. The long beam thus formed a series of vacuum cups and instantaneous attachment to the wall could be made merely by turning on a valve in a line leading to the pump used with vacuum processing of the concrete. The vacuum connection held the wall to the beam with a force of 25 tons whereas the actual weight of the wall was only 3 tons.

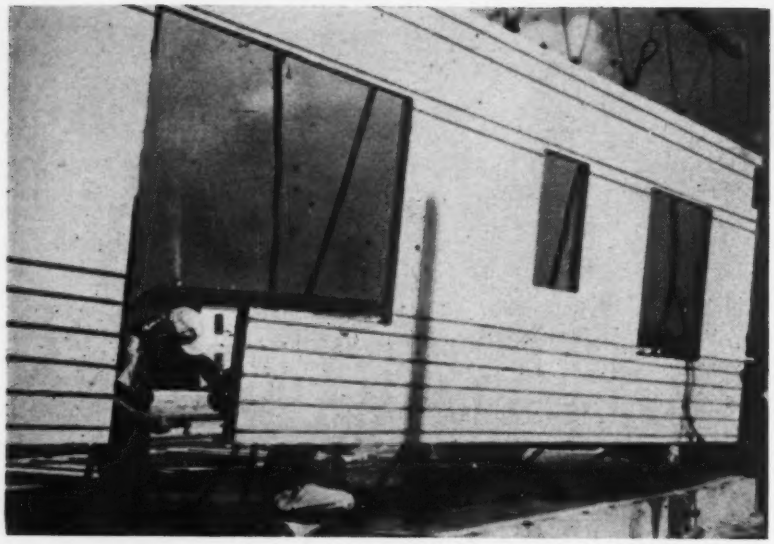


Fig. 3. Wall of 2½-in. thick concrete reinforced with prestressed steel being placed four days after pouring.

This method of lifting has another advantage beside that of quick attachment. It is possible to grab anywhere on a flat surface, thus reducing bending moments very materially. However, the success of handling the large, thin flat slabs, weakened by door and window openings, was due to prestressing of the concrete and steel. Any appreciable tension in the concrete would have resulted in cracking, but the concrete was in a state of compression throughout because of the prestress and therefore it could not crack.

The ends of the walls of the first house were mitered and grouted together, and were fastened to one another with small pieces of angle iron after the walls were in a vertical position. The corners of the second house were cast, after the walls were up, by the use of vacuum process forms, which were removed 15 minutes after the concrete was put in place.

Wood furring strips, with nails running through them, were placed on the top face (interior wall) of the concrete immediately after it had been poured and vacuum processed. Finished wall-boards ½-in. thick and 2-ft. wide and the full height of the wall were nailed to the furring strips after the walls were up to serve as the exposed interior.

The building of these houses, the first adaptation of prestressed steel and vacuum processing to building, proved so successful that many more are to be built at once. H. T. Underwood, architect and chief of housing for the Gulf Coast Regional Office of the U. S. Maritime Commission, authorized the experimental work on the houses. Leo Elliott of Tampa made the architectural plans for the units and they were built by J. A. Jones Construction Co. of Charlotte, N. C. Patents on the method are held by the author.

New Highway Safety Laws Will Take Effect in Ohio

To promote safety on Ohio's roads and streets and to insure adequate financial compensation to innocent victims of accidents involving motor vehicles, amendments to the state's Safety Financial Responsibility law, will become effective Sept. 20. Thereafter when a court judgment is obtained against an individual in consequence of a motor vehicle accident, he must satisfy the judgment or have his driving license revoked for a period of five years. However, these driving rights cannot be suspended until the registrar of motor vehicles has served notice requiring such person to satisfy or to stay execution of the judgment within 30 days from date of the notice, or show cause why his driving license should not be lifted.

The registrar is required to vacate the suspension order upon proof of the satisfaction of the judgment after the order has become effective. Whenever an operator of a motor vehicle is convicted of manslaughter resulting from operation of a car; driving under the influence of liquor or narcotics; failure to stop after an accident; commission of a felony in which a motor vehicle is used, the registrar shall revoke the offender's driving license for a period of three years, unless that person shall have satisfied the registrar of his ability to meet all damages.

In the event a person continues to operate a car after revocation of his driving license, such person is deemed guilty of a misdemeanor and upon conviction faces imprisonment for not less than six months and a fine of not more than $500. The amendment to the motor vehicle laws also provides that no vehicle shall be driven to the left of the center line of a roadway when approaching within 100 ft. of an intersection or railroad grade crossing. This is designed to prevent vehicles pulling out of traffic lanes in such dangerous localities on the highways.

Liberalization of the driver licensing law, designed for the benefit of servicemen and women home on furlough, is contained in an amendment effective Aug. 24. This amendment enables any person on active duty with the United States armed forces to drive without a license providing he was licensed by the state at the time of entering service.

Another amendment to go into effect provides that the registrar of motor vehicles may waive examination for a driver license, providing such service man or woman can present an honorable discharge certificate showing he has no physical or mental disabilities.

The age limit for the standard chauffeur's permit was also reduced from 18 to 16 years, with a restricted license being issued under certain circumstances to persons 14 or 15 years old.

Notes on Shipbuilders Technique For Release of Welding Stresses

● In the future, structural engineering students doubtless will be given instruction in the principles of arc welding to facilitate their understanding of welding layout to avoid stresses from unequal heating. Meantime, one who does not have the background of the trained welder can learn much that will help in an analysis of stresses in welded structures by studying well-known principles of steel behavior under heat to determine what happens when electric welds are made. The following notes, made in the course of visits to shipyards where large welding operations are in progress, are presented for the benefit of others engaged in welded ship construction and for those who in the future may wish to apply welding to other types of heavy structural work —The Editors.

WHEN STEEL IS EXPANDED by heat and then contracted, in the cooling that follows the forces that are set up act equally in all directions. Where different temperatures and hence different rates of cooling occur in adjacent areas, it is natural that resultant stresses should cause distortion and even failure. Contraction to less than the original measurement in one or two of the three dimensions is almost certain after steel has been subjected to temperature change. This property is demonstrated by the fact that a cube of steel, repeatedly heated and cooled, ultimately takes the form of a sphere.

The very great heat generated in electric welding inevitably causes stresses in the metal being welded. The trick is to lay out welding sequence and procedure so as to avoid as many as possible of the harmful, locked-up stresses. This is where engineering analysis has shown how to minimize the harmful effect of the welding heat.

Even a few beads laid with an electric arc in the center of a steel plate will set up internal stresses of many thousand pounds. If the plate is struck repeatedly on the edge with a hammer while the metal is still hot from the welding, the locked-up stresses can be materially reduced. For structures where annealing is impracticable, this vibratory method is an effective means of reducing residual stresses.

In many welding operations hammering (peaning) is done extensively. The usual method is to pean about 14 in. behind the arc—working closer would interfere with the welder and at greater distance the metal may be too cool for optimum results. Unless peaning is done before the metal cools, not only is the stress-relieving effect greatly reduced but the metal is made brittle. An effective peaning tool is a pneumatic chipping hammer fitted with a round head that will not cut the metal.

Although internal stress resulting from the heat generated in welding cannot be prevented, the harmful effects can be kept to a minimum by following a program of "welding sequence" based on a knowledge of what takes place under welding heats.

In general, all major welding operations should start at or about the welding center and progress "outwardly" on a symmetrical basis. It should be the rule not to continue any weld beyond the intersection with an unwelded seam. Excessive reinforcement of the weld by building up to greater thickness should be avoided. (In shipbuilding, projections of more than $\frac{1}{8}$ in. are considered excessive.) Tack welds should not be longer than about 1 in. and not closer than 18 in. Tack welds should not be within 18 in. of an intersection with another seam or the end of the joint.

Minimizing stresses

Welding methods that tend to minimize locked-up stresses include: (1) running successive beads in opposite directions; (2) using the "block system" in which a 10-in. length is welded, a 20-in. length is skipped, another 10-in. stretch is welded and so on, later filling in the gaps and peaning all welds while they are warm; (3) working welders simultaneously on opposite sides of the same joint (known as the "twin-arc" method). If the welders keep abreast of one another the resultant tendency to bow is equal and opposite on the two sides and hence the stresses tend to balance. This method is recommended only where both welders can work on horizontal or vertical welds. It has disadvantages where one is welding overhead and the other downhand.

Lack of attention to proper welding sequence has been accepted as a major factor in the failure of the 10,000-ton tanker Schenectady, *ENR*, March 25, 1943, p. 405. Several breaks that have occurred near the midship section of the EC-2 type freighter and other welded vessels are typical of lack of proper attention to welding sequence.

To make sure of avoiding interference with a properly laid out sequence, once a prefabricated section is put together, it should be disturbed by additional welding as little as possible. Chipping out, moving brackets and doing pick-up work promiscuously on different parts of a completed assembly may completely nullify the advantage of proper sequence and procedure. Each major weld must be completed properly and finally as the work progresses. The assembly of parts should be completed separately, as far as possible, and their addition to the group as a whole should be scheduled as part of a carefully balanced procedure.

In addition to the contraction or shrinkage of the base metal as the result of welding heat there also is shrinkage of the weld metal itself. The weld is a form of cast metal and when it cools it will shrink just as any other steel casting does. When stresses exceed the yield point a permanent set takes place in the immediate vicinity of the spot where the intense heat was applied. If the members are restrained at the time of cooling, residual stresses may extend into the parent metal. In extreme cases of restraint or of very rapid cooling these stresses may exceed the ultimate strength of the metal.

Fortunately, residual stresses are not fixed and permanent. After being set up they immediately begin a dissipation or distribution known as "creep." Dispersion of the residual stresses is fairly rapid (a matter of days) while such stresses are high, and slows down (into weeks or months) after partial relief has taken place.

To sum up: Prominent factors that contribute to residual stresses are: (1) too rapid cooling of the deposited weld metal and the adjoining base, (2) excessive restraining of the members either through mechanical means or by excessive tack welding, (3) lack of a proper welding sequence and procedure, (4) improper design such as sharp changes in continuity and thickness, (5) stress concentrations resulting from notches, excessive undercuts and poor penetration producing "hard spots," and (6) the fact that the strength of the weld metal while at high temperature is much lower than when cool. Because of the latter condition, the first bead in a weld between heavy sections which are not otherwise restrained, may have to take nearly all the stresses (because of the more rapid cooling of the parent metal) before it has had time to cool and hence while it is comparatively weak. When the type of joint will permit, preheating the parent metal before welding will greatly reduce this hazard.

There is no question of the great advantage, especially on thick plates, of automatic machine-arc welding. In this method the metal is heated only once and cools only once, thus giving a minimum of complications from repeated stress reversals and resultant locked-up stresses. However, it is a serious mistake to weld by this method to within a few inches of the edge of a deck seam and then finish out with hand welding. In this way the connections between important members are weakened to the danger point. Because of the danger in such combinations of the two methods, and because machine welding equipment is better suited to shop work than to service, as portable equipment, some shipyards expressly forbid the use of welding machines on parts that have been placed on the ways. This limitation is made despite the recognized advantages of machine welding

Two-Hinged Timber Roof Trusses Use "Synthetic" Gusset Plates

***Contents in Brief**—To save critical materials and, particularly, because structural plywood was not available for gussets, a roof is carried on arches of 50-ft. span built up with timbers of standard sizes. Gussets consist of 4x4's set side by side and keyed together by mortised shear blocks.*

LACK OF PLYWOOD in 3-in. thickness to be used as gusset plates and a desire to avoid use of critical material, led to an unusual design of two-hinged timber arches for supporting the roof of a school auditorium on the West Coast. In lieu of plywood, joints in the arches were made with the aid of "synthetic" gussets consisting of short timber members keyed and bolted into the principal arch members in such a way that a remarkable degree of rigidity resulted in the individual arches and also in the completed roof structure.

The auditorium is 50x85 ft. in plan, and the roof is carried on five two-hinged timber arches spaced on 14-ft. centers. These arches have a rise of 35 ft., and the hinges are tied together by a reinforced concrete member extending across the building beneath the floor. Each arch footing is set in the reinforced concrete stirrup, cast as part of the foundation, whose detail is shown in the accompanying drawing.

The floor of the auditorium, which was laid as soon as the concrete foundation had set, served as a working platform on which to fabricate and assemble the arches. Each arch was set up in a single piece with the aid of a gin pole. A crew of ten including carpenters and laborers worked an average of 2¾ eight-hour days on each arch assembly.

If 3-in. plywood had been available for gusset plates considerable time in fabrication would have been saved. Instead of making use of the usual gussets, however, it was found possible, at the joint between roof and side walls, to fill in spaces between roof and wall timbers into the form of a solid beam 3 ft. 10 in. wide, by use of shear blocks fitted and keyed in between the main timbers. The structure was designed to carry 15 lb. of wind or a horizontal force of 0.1 *g*, whichever governed in the several analyses.

A similar "synthetic" gusset was formed at the crown of the arch, here again figuring the moments for reversal of stresses. At the crown the stresses were the opposite of those occurring at the haunch: the inner or lower edge of the gusset being in tension and the top in compression. The arch assembly as a whole has some features closely resembling the Vierendeel girder.

The purlins, 6x12-in. timbers spaced 9 ft. center to center, support 3x6-in. rafters on 2-ft. centers. The rafters support 1¼-in. t. & g. sheathing overlaid by tar-felt and clay tile roofing. Exterior walls are finished in cement stucco; the inside is furred with expanded metal and plastered. Total cost of the structure was about $135,000. The structural frame, excluding roofing, plaster and stucco, was completed with about 1,100 man-hours.

As an aid in making rough comparative estimates, a breakdown of costs on the arches alone was made with special reference to lumber, hardware and labor. The auditorium has an area of 4,250 sq.ft., and there are five arches in addition to roof

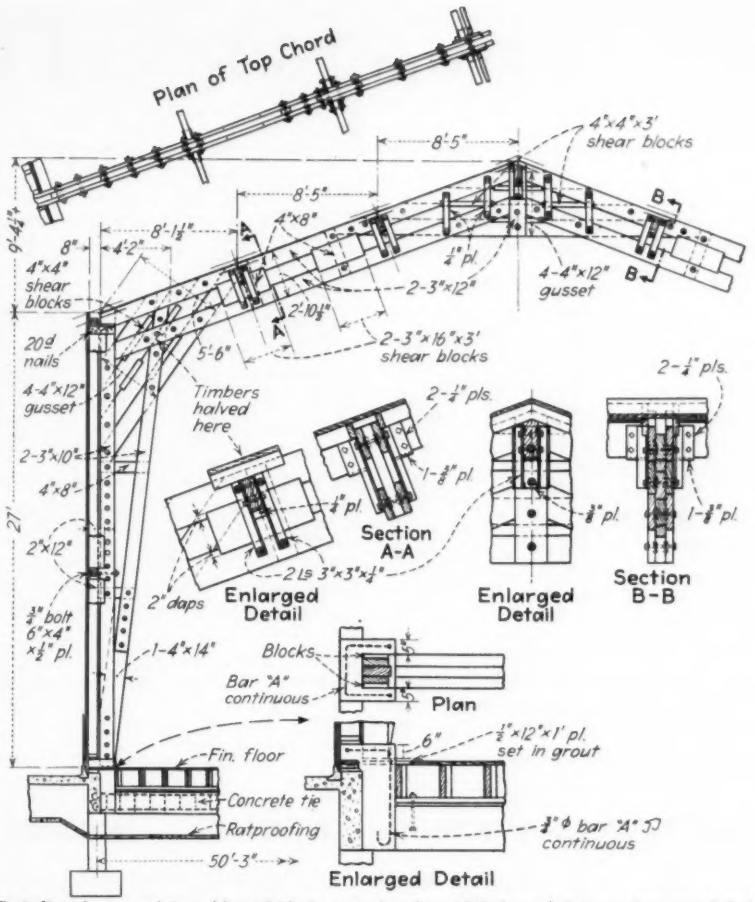
supports provided by the two end walls. The timber used in each arch totaled 2,100 b.ft. which was bought at a base price of $60 per thousand board feet. Thus:

Lumber (5 x 2100 @ $60/M)	$630.00
Hardware ($133 x 5)	665.00
Labor (1100 man-hr. @ $1.50)	1,650.00
	2,945.00
10% contractor's fee	294.50
	$3,239.50

Dividing this total arch cost by the auditorium area gives 76 cents per sq.ft., the unit area cost for arches alone. If to the total arch costs is added the $2,200 that represents costs, in place, for purlins, rafters, sheathing, felt roofing and clay tile, the total roof structure cost per square foot is found to be $1.28.

Breakdown of Cost

Breaking down the arch costs alone, in terms of board feet, and adding to each a 10 percent contractors' fee, the materials (timber and hardware) were found to total $136 per thousand and the labor $172.50 per thousand board feet. These add up to a total roof structure cost (walls not included) of $308.50 per thousand board feet. Labor and materials are both believed to be about one-third above "normal" levels by reason of present wartime activities. Thus, it was suggested that instead of $308.50, a price of $200 per thousand would be a more average "normal" figure.



Details of unusual two-hinged timber arches in which knee joints and crown joints consist of 4x4-in. timbers set side by side and keyed together by mortised shear blocks.

The design was developed by Thomas F. Chace, consulting engineer. Paul A. Ryan was the architect and Barrett & Hilp the contractors.

Non-Absorbent Mold Material For Casting Concrete Beams

In casting precisely dimensioned concrete beams, plaster shapes, refractory cell hoods and other materials required to resist acid and electrolytic exposure in a large industrial plant, it was necessary to make the molds of some material that would not absorb moisture, shrink or warp in the slightest degree while the castings were hardening. Search for a more suitable material began when molds made of specially treated wood proved to be wholly unsatisfactory. A successful material which solved the serious problem on the construction project was found in a compound of three ingredients.

The materials and the way they are proportioned is as follows:

2 parts of ground refractory firebrick
2 parts of Carbo-korez powder
1 part of Carbo-korez liquid

The ground firebrick was a job-made substitute, costing about $6 per ton, which replaced crushed flint, used at the start, costing about $60 per ton, delivered. The other two ingredients are commercial products (Atlas Mineral Products Co., Mertztown, Pa.) consisting chiefly of synthetic resins, combined with carbon, commonly used for pointing brick or tile joints where qualities highly resistant to chemicals are required.

The formula by which these ingredients were mixed, follows: "Pour the Carbo-korez liquid in a container or mixer, such as a plaster mortar mixer. Add Carbo-korez powder and mix until smooth and free from lumps and trapped air. Then add the ground brick and mix thoroughly for 2 or 3 min. It is then ready to pour into wood molds which should be greased with stiric acid and coal oil. The setting time varies with temperature from 3 hr. to 3 days."

The development of this non-shrinking mold or form material was worked out under the direction of Eddie Cleeton, general superintendent, masonry division, and Emil Lorenzoni, superintendent, masonry shop, of the McNeil Construction Co., Los Angeles contractors.

From Field and Office

WORKING PROBLEMS AND TIME-SAVING METHODS FOR ENGINEERS AND CONTRACTORS

Paying Proper Attention to Clips Will Lengthen Life of Wire Rope

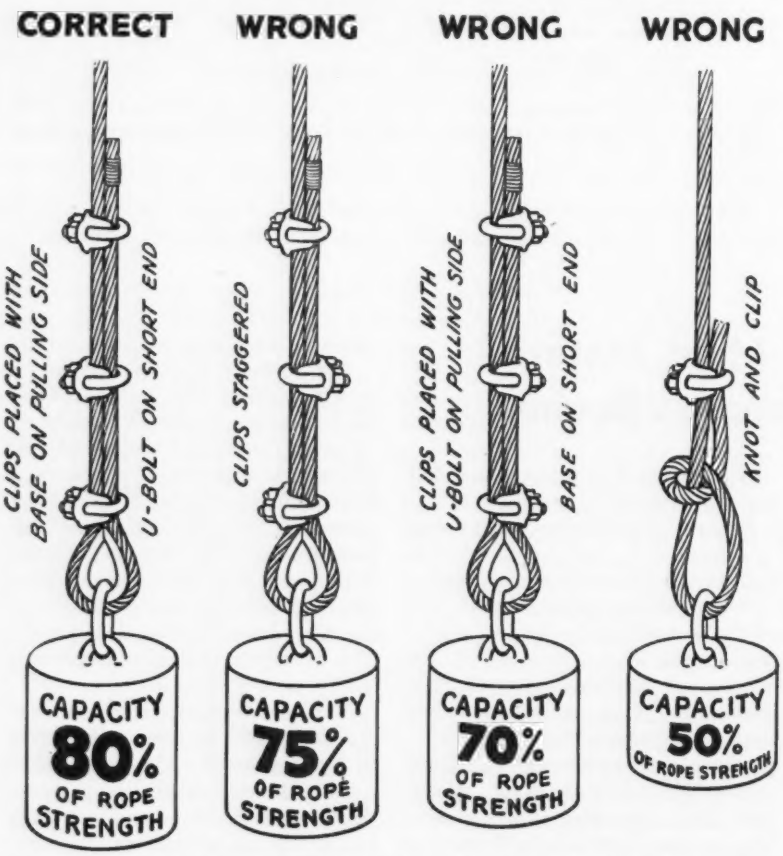
In these days when replacements of wire rope are hard to get, and machine shutdowns are more costly than ever before, proper use of the cable clips is very important. Much longer cable life is possible if a few precautions are taken in regard to cable clips. These include: (1) Clips should be evenly spaced at about 6-times the rope diameter or more; (2) clips should not be drawn up too tight against the rope, but neither should they be permitted to become loose; (3) with the clips fastened, all nuts should again be tightened after the rope has been put under tension; (4) clips should be tightened with every rope inspection; and (5) when inspecting clip fastenings, it is extremely important to examine the rope at the last clip fartherest away from the loop or bight.

The last precaution is very important as fatigue breaks often develop at the last clip, due to the fact that rope vibration or whipping is dampened here. Fatigue damage is less pronounced with preformed wire rope, which may be explained by the reduced tendency of preformed rope to vibrate or "whip."

It also is important to apply a sufficient number of clips, and the minimum number recommended for different sizes of rope is as follows:

Rope Dia., Inches	Number of Clips	Spacing, Inches	Wrench Length, Inches
½ to ⅝	3	3	12
¾ to ⅞	4	4½	18
1 to 1¼	4	6	24
1¼ to 1½	5–7	24	24
1½ to larger	5–7	10	24

An accompanying drawing illustrates three clip fastenings to be avoided if long cable life is desired.—F. L. SPANGLER, *mechanical engineer formerly editor of The Welding Engineer.*



Greatly increased efficiency of clip fastenings will result if the three errors shown above are eliminated.

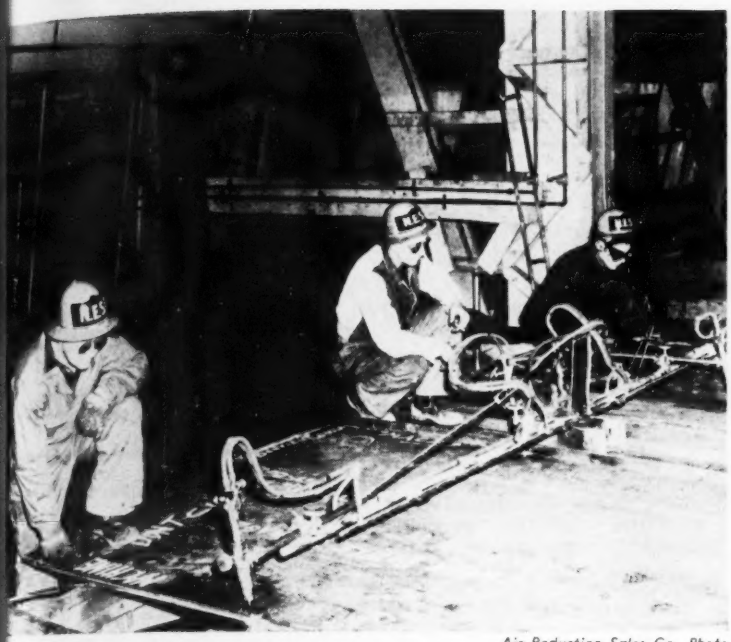
Multi-Torch Increases Oxyacetylene Cutting

A shop-built multiple-torch greatly increases the productive output of a portable power-driven, oxyacetylene cutting machine used in a New England shipyard. The unit in a single stroke does the work normally produced by two or more machines. As shown by the accompanying photograph, the attachment consists of a 10-ft. bar balanced crosswise on the machine. The ends of the bar are supported cantilever fashion by turnbuckled rods welded at the apex to a plate section. The bar carries four torches in adjustable positions for trimming parallel edges simultaneously on two plates, one on each side of the machine tracks.

The 40-ft. track for the machine is laid in the trough of several sections of structural channel welded end-to-end, providing protection while the plate is being laid out. Cumbersome lengths of gas hose are eliminated by the use of gas pipes mounted parallel to the torch bar. Four round mounting pads are welded at intervals on each side of the bar so that the torches can be fixed in any position along the bar. This arrangement permits fine adjustments by the rack and handscrew supporting each torch.

Not only is linear cutting quadrupled by the device, but parallel plate edges are cut accurately. The secondary benefit is, of course, a more precise fit-up in assembly, with consequent speed-up of welding butt joints. Three operators are required to maintain torch adjustment, but on regular production work the machine has produced 1,240 lin. ft. of cutting in 8 hr. The average for a single ordinary machine at these yards is 300 ft. per 7-hr. shift.

While the device illustrated is of



Air Reduction Sales Co. Photo

A job-made multi-torch for plate squaring when powered by a standard portable, power-driven, oxyacetylene cutting machine quadruples production.

limited application, as compared to the large shape-cutting machines whose territory it trespasses upon, it is a very serviceable substitute in shops where those machines are overburdened with work.

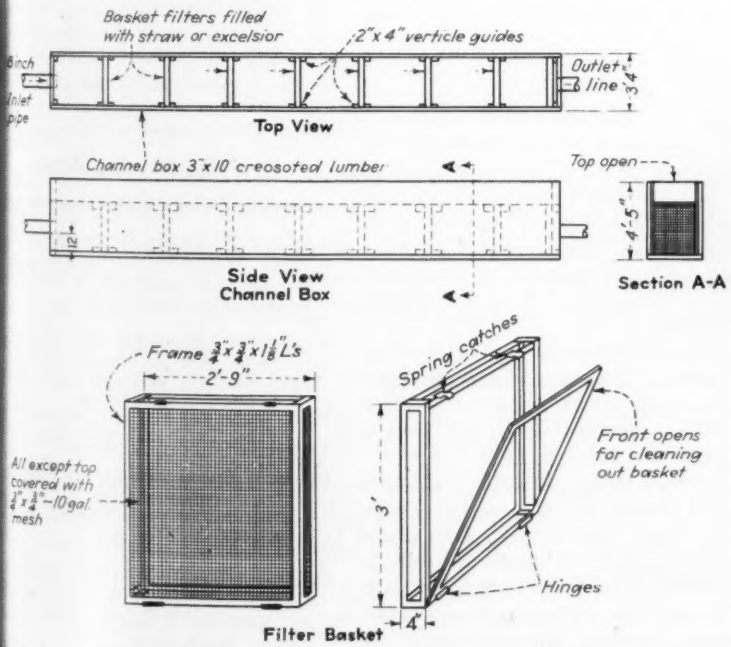
STRAW FILTERS REMOVE OIL WASTE FROM LOCOMOTIVE WASH WATER

Waste water containing a mixture of distillate oil and caustic soda, used for washing the locomotives at the Denver & Salt Lake (Moffat) Ry. Utah Junction shops near Denver, drains into an irrigation water supply. Upon complaint of the farmers in the irrigation district, that the oil pollution was detrimental to crops, the railroad took steps to end the nuisance. As the washing pits are distant from and below the city sewer system, a catch basin, pumping plant and long pipeline would be required to discharge the waste into the sewer. The railroad sought a cheaper method of removing the oil.

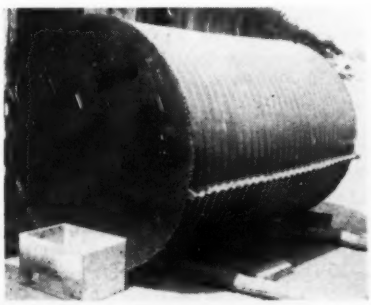
A system of straw basket filters, designed in the railroad's engineering office, has proved successful in separating the objectionable oil from the waste water. The system, shown in the accompanying drawing, consists of a channel box of 3x10-in. creosoted lumber, 32 ft. long, 3 ft. 4 in. wide and 4 ft. 5 in. high, in which a series of mesh-covered, angle frame baskets are set. The baskets, 4 in. wide and 3 ft. high, are filled with straw or excelsior. They slide into guides of 2x4-in. strips, which also act as ties across the box, and can be removed one at a time for cleaning.

Experience has shown the oil adheres to the straw, and the effluent is oil-free. One side of the basket frame is hinged to permit dumping of the fouled straw when the baskets are pulled out. The baskets are cleaned and filled with fresh straw about twice a month.

The entire system was built at a total cost of $239, which is considered cheap for the results obtained.—ED. SUNERGREN, *Office Engineer, D. & S. L. Ry., Denver, Colo.*



Straw baskets in box channel remove oil from waste water at Moffat Ry. shop.



Tanks Built of Culvert Pipe

When storage tanks could not be obtained in Honduras for use in constructing the Inter-American Highway, the Swinerton-McClure-Vinnell organization, general contractors, built large drums of metal culvert sections. The drums are of all welded construction and the Swinerton organization found excellent use for several of the tanks on the 175 miles of the road it is building in Honduras and Nicaragua.

Book Notes and Reviews

The month's addition to the engineer's reading and reference list

Trees on Construction Jobs

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A CONSIDERABLE PART of this book is addressed to engineers engaged on construction operations that may cause the loss of useful trees if not properly carried out, or may, if executed according to the methods outlined, make possible the preservation of trees that should be maintained for beauty or utility. In an apparent effort to give the book a war character there is woven through its whole fabric a discussion of trees as protection against air attack. This is unfortunate, especially as most of what is said on the subject is not in harmony with accepted camouflage practice.

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Five works relating to drawing have appeared in recent months, two are new and the others are revisions of earlier texts.

Prof. Luzadder's book is new. It is designed to provide a nearly self-teaching book in which drawing is treated as a graphic language. Its purpose is to relieve instructors of the monotonous work of teaching the student the details of drawing methods, freeing them for more attention to major problems. Prof. Luzadder's illustrations are well chosen for his purpose.

"Basic Problems in Engineering Drawing" is a series of punched loose-leaf work sheets, chiefly of machine details, designed to give students a grasp of fundamentals.

"Engineering Drawing: Practice and Theory" is an expansion of the late Prof. Carter's book. Beyond the fundamentals, it relates largely to machine drawing, but includes short chapters on architectural and structural drawing. To supplement the text, Prof. Thompson has prepared the problem book of 160 plates of drafting exercises, 8½ x 12 in., printed on heavy paper and perforated for easy removal.

The title adequately describes Prof. Field's book on architectural drawing. Typographically and in the character of its illustration, the artistic influence is clearly evident. This new edition of the book contains information on orthographic projections not contained in the first edition.

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THE ECONOMICS OF HOUSING AND SLUM CLEARANCE, a paper by George H. Herrold, planning engineer, City Hall, St. Paul, has been reprinted by the American Interprofessional Institute. Copies may be obtained from Mr. Herrold.

BITUMINOUS PAVEMENT CONSTRUCTION METHODS are well described and much information on bituminous road materials is given in "Bituminous Construction Handbook," issued by the Barber-Greene Co., Aurora, Ill. The book is an amplification of a booklet originally prepared for the company's own service men.

New Engineering Books

ANALYTIC MECHANICS—(A revision of Mechanics of Engineering). By S. O. Chambers and V. M. Faires. 351 pp. Macmillan Company, New York. $3.75.

ENGINEERING MECHANICS—By Ferdinand L. Singer. 476 pp. Harper & Brothers Publishers, New York and London. $4.

FLUID MECHANICS—By R. C. Binder. 296 pp. Prentice-Hall, Inc., New York. $5.

HIGHWAY RESEARCH BOARD—Proceedings of the Twenty-second Annual Meeting. 494 pp. The Highway Research Board, Washington, D. C. $3.25.

COUNTY OF LONDON PLAN—1943—By J. H. Forshaw and Patrick Abercrombie. 188 pp. Macmillan & Co., St. Martin's St., London, W.C.2. Price 12s 6d.

(*Continued on page 117*)

Aviation—A Progress Report

The Lessons of War Become the Key to a Richer Peace

UNISIA, PANTELLERIA, SICILY—stepping stones to momentous events! But that is not all. For they spell out across the blue waters of the Mediterranean a pattern of invasion that has progressed since last summer's first major Commando operation against the French coast.

From Dieppe, you remember, too many of the raiders never got back. But in Tunisia, and on through Sicily, the Allied might plowed inexorably forward, winning objective after objective at a surprisingly low cost in casualties. Air supremacy over the battlefield? Yes. But we have learned, too, how to save lives and shorten the war by strategic air bombardment as a prelude to invasion.

Thus the bombardment line—rarely seen by the doughboys on the fighting fronts—is destined to save their lives by hundreds of thousands in the decisive attacks that are to come. This fact is confirmed by the cold calculations of the responsible strategists. It will give renewed courage and confidence to every member of the armed forces and of the home fronts throughout the United Nations.

For instance: thorough strategic bombardment of an objective reduces by nearly fifty per cent the surface forces required for invasion. Anticipated losses are reduced from more than fifty per cent of the original ground force to about twenty per cent. Precision bombardment—as used on railroad objectives in Rome—reduces this percentage of loss still further when it is followed by offensive action on the ground.

This is the fifteenth of a series of editorials appearing monthly in all McGraw-Hill publications, reaching more than one and one-half million readers. They are dedicated to the purpose of telling the part that each industry is playing in the war effort and of informing the public on the magnificent war-production accomplishments of America's industries.

The inference is clear. Effective prosecution of the war will require smaller ground combat forces and much larger air forces than some of our strategists once thought.

Our most urgent need, then, is for ever-mounting fleets of aircraft. And, fortunately, this is just what we are getting. The American aircraft industry now is producing as many airplanes as all the rest of the world combined. In 1938 we made 100 planes a month. Now we make three times that many in a single working day. By the end of 1943, our production rate will be about 10,000 a month.

But at this stage of the war, types of planes are more important than mere numbers. In the early months the program was heavy, and properly so, with single-engine trainers. Then, as training planes accumulated, the emphasis shifted to heavier types. Now we are turning out multi-engined bombers at a rate that is the envy of the entire world. Some months ago the President revealed that we were manufacturing 500 long-range bombers every month. The figure was conservative even then. And soon we shall be producing planes of this one type at a rate adequate to replace the normal losses of a fleet of at least 1000 American heavy bombers operating as continuously as the weather will permit.

A glimpse of the poundage production may help us still further to evaluate the miraculous achievements of the aviation industry as a whole. It was 89,000,000 in 1941 . . . 291,000,000 in 1942 . . . 911,000,000 in 1943 . . . and 1,417,000,000 in 1944

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– if we need it. There you have the magnificent record of the American aircraft manufacturing industry – a monument to the cooperation of industry, labor, government, and to all-out teamwork between the aviation industry and those other industries which have converted their facilities to the manufacture of airplanes.

What of our enemies and our Allies?

German production probably has flattened out at 2500 a month – with downward revision in immediate prospect. Japan may be able to produce as many as 1000 planes a month – until we get our new long-range super-bombers in sufficient numbers to whittle down that figure. Italy may be able to turn out her 500 a month – for a little longer. At best the maximum Axis monthly total is 4000.

Add to our monthly score of nearly 8000, a total of approximately 4000 for Britain, Canada and Russia, and the United Nations score comes to 12,000 monthly. There we have a three to one advantage for our side. And between our own rising production and the brilliant operations of our bomber commands we should soon boost the ratio well above that figure. Therein lies the certainty of continued and growing air superiority over all the far-flung battlefields.

The critics of American airplane quality have been silenced ever since the ratio of enemy combat losses to our own on bombardment missions surpassed four to one. In the Pacific where our heavily armed and armored planes are knocking off the desperately stripped racing craft of the Nipponese, enemy losses often run as high as eight to one or more. In the Mediterranean theater, where the Italians were abandoned by their Allies, the story is much the same. Only in the well-defended homeland of the Nazis do we sometimes drop below the average, but even in those rare instances the ratio is still well in our favor and the effectiveness of our bombardment is adding constantly to our margin.

* * *

Behind the production lines the battle of research and design still rages. In many a laboratory night-shift, on many a secret test field, new and terrible surprises for the enemy are in the making. Super-bombers, destined for Tokyo, have long since passed out of the design stage and the Japanese may learn about them almost any day. New discoveries, designed to sow swift and silent devastation, are farther along than our enemies believe. No longer will fog or storm or night be permitted to fight on the side of our foes.

The men of science who are toiling to broaden the horizon of our knowledge stand today on the threshold of discoveries that have been sought for centuries. New reservoirs of power may soon exert a profound influence in many fields of technology and through them on our way of life.

Once the war is won these new discoveries will be translated into better living. No longer will countless thousands spend their lives within the confines of their own communities or countries. New efficiencies in transportation will bring world travel within the reach of many who once had to stay at home. New family vehicles will navigate the skyways as easily and safely as the highways. Already more than a dozen manufacturers of airplanes, ships, automobiles, and electrical equipment are designing, building, or flying rotary-winged aircraft such as the helicopter or autogyro to meet the needs of tomorrow's families. New and safer aircraft of the fixed-wing type are ready for production as soon as materials become available.

The quality that now makes each of our warplanes worth so many of those built by our enemies will be translated into the sturdy reliability demanded by peacetime operation. The devices that seek out and find our enemies behind the veil of fog or darkness will, after the war, reduce weather hazards to the point where they will be no greater in the air than on the ground.

Science and industry will continue to do their jobs and do them well. But if the world is to be made a better place for men to live in, statesmanship must not fail to do its part.

James H. McGraw, Jr.

President, McGraw-Hill Publishing Company, Inc.

Let this Exide Catalogue Solve your "Off-the-Highway" Battery Problems

NO matter what your Heavy Duty Battery problems may be, you're bound to find the answer in Exide's catalogue addressed to the field. It combines all the "know-how" of Exide's Engineers. It tells you how to maintain your batteries regardless of their make—also, how to select the proper type and size of Exide Heavy Duty Batteries for your equipment.

Write for your free copy today.

Wherever Heavy Duty Batteries are used for "Off-the-Highway" equipment, you can bet your bottom dollar on Exide efficiency. These batteries are sturdy specialists, built to *take it* when the going gets tough, and built to *hand it out* when a dependable flow of current is needed most.

THE ELECTRIC STORAGE BATTERY COMPANY
Philadelphia
Exide Batteries of Canada, Limited, Toronto

ARMY E NAVY

BUY TO LAST
SAVE TO WIN

Exide
HEAVY DUTY
BATTERIES

CONTRACT UNIT PRICES

What contractors are bidding on different kinds of construction work

SEWAGE TREATMENT PLANT, SEWERS HOPKINSVILLE, KY.

OWNER: Kentucky Dept. of Welfare, Frankfort, Ky.

PROJECT: Construction of sewage treatment plant and sanitary sewers at Western State Hospital, Hopkinsville, Ky., 1½ miles east of the city on U. S. Highway No. 68.

CONDITIONS: Contractor to furnish all materials and complete work in 180 calendar days. Rail and highway transportation facilities available. Wage rates are: skilled labor, $1.15 to $1.50 per hour; semi-skilled, 50 to 60c.; and common, 45c.

BIDS: Three bids were received August 3, 1943, ranging from the contract low of $76,160 to $102,488.

LIST OF BIDDERS:

1. E. H. Marhoefer, Jr., Co., Chicago, Ill. (contract) $76,160
2. Coleman, Trainer & Co., Huntington, W. Va 83,763
3. W. L. Hailey & Co., Nashville, Tenn 102,488

Item	Quan.	Unit Prices (1)	(2)	(3)
1. Sewage treatment plant	Lump Sum	$52,525.00	$62,588.40	$70,000.00
2. 12-in. cast iron pipe	162 l. f.	5.00	3.00	5.00
3. 21-in. reinforced concrete pipe	50 l. f.	3.00	3.50	3.00
4. 2-in. cast iron pipe	600 l. f.	.70	.90	1.00
5. 12-in vitrified clay pipe	4,195 l. f.	1.20	.85	1.50
6. 10-in vitrified clay pipe	1,236 l. f.	1.00	.75	1.25
7. 8-in. vitrified clay pipe	2,300 l. f.	.85	.60	1.00
8. 6-in. vitrified clay pipe	200 l. f.	.70	.50	.90
9. 12-in. vitr. clay fittings	6 ea.	4.00	2.50	4.00
10. 10-in. vitr. clay fittings	10 ea.	3.50	2.25	3.00
11. 8-in. vitr. clay fittings	15 ea.	2.50	1.75	2.50
12. 6-in. vitr. clay fittings	10 ea.	2.00	1.25	2.50
13. Vitrified clay steppers	25 ea.	1.00	.20	.50
14. Trench, 0 to 4-ft. deep	4,320 l. f.	.50	.55	1.00
15. Trench, 4 to 6-ft. deep	3,592 l. f.	.60	.70	1.25
16. Earth fill	188 c. y.	1.00	.60	2.00
17. Masonry foundation	68 c. y.	15.00	7.00	30.00
18. Manholes, 2 to 4-ft	16 ea.	60.00	50.00	100.00
19. Manholes, 4 to 6-ft	17 ea.	90.00	70.00	125.00
20. Manholes, 6 to 8-ft	1 ea.	110.00	85.00	150.00
21. Extra depth for manholes	1 ea.	25.00	15.00	25.00
22. Concrete walks	50 l. f.	1.20	1.25	2.00
23. Tunnel under walks	44 l. f.	3.00	2.00	8.00
24. Tunnel under highway	30 l. f.	10.00	5.00	10.00
25. Crushed rock, for roads	55 ton	3.00	2.00	3.00
26. Stone chips, for trench	100 ton	2.50	2.00	2.50
27. Concrete piers	1 c. y.	60.00	40.00	40.00
28. Highway paving	25 l. f.	2.00	.85	4.00
29. Cast iron fittings	20 lb.	.15	.15	.10
30. Rock excavation	560 c. y.	8.00	10.00	7.00

CONCRETE RESERVOIR SALT LAKE CITY, UTAH

OWNER: City of Salt Lake City, Utah; W. D. Beers, city engineer.

PROJECT: Constructing the Louis Marcus Reservoir and appurtenant structures, 3rd East St. and Gordon Lane in Salt Lake County, Utah. The concrete reservoir is to have 3,000,000-gallon capacity and is to be half embankment and half excavation, with sloping sides of concrete, and a timber roof.

CONDITIONS: City to furnish cast iron pipe and fittings, gate valves, and altitude control valve. Contractor to furnish all other materials and complete work in 90 days. Highway transportation facilities available to site of work. Prevailing wage rates are: skilled labor, $1.25 to $1.40 per hour; semi-skilled, 90c. to $1.00; and common labor, 65c.

BIDS: Seven bids were received May 25, 1943, ranging from the contract low of $74,968 to $96,232.

LIST OF BIDDERS:

1. Enoch Smith & Sons Co., Salt Lake City, Utah (contract) $74,968
2. W. W. Clyde & Co., Springville, Utah 81,329
3. Olson & Lucas Constr. Co., Salt Lake City, Utah 84,65
4. Gibbons & Reed Co., Salt Lake City, Utah 89,97
5. George M. Carruth & Son, Evanston, Wyo 92,48
6. F. R. Knowlton, Layton, Utah 95,86
7. J. B. & R. E. Walker, Salt Lake City, Utah 96,22

Item	Quan.	Unit Prices (1)	(2)	(3)
1. Excav. and embankment (incl. upper section of waste water trench)	5,400 c. y.	$0.50	$0.48	$1
2. Excav. and waste (incl. grad. and embankment for access road)	6,900 c. y.	.50	.40	
3. Fine grading and excav. for rib trenches and reservoir drains	1,150 c. y.	2.00	2.00	2
4. Excav. and drainage (outside reservoir)	230 c. y.	1.50	2.00	1
5. Excav., bkfill. of waste water trench from collecting box to creek	450 c. y.	1.50	2.00	1
6. Excav., bkfill. for outlet wks. and valve box	600 c. y.	1.50	2.00	2
7. Excavation for structures	200 c. y.	1.50	2.00	1
8. 6-in. b. & s. vitr. pipe, open joints	820 l. f.	.40	.51	
9. 18-in. b. & s. conc. pipe, tight joints	600 l. f.	2.00	2.00	1
10. Gravel in trenches, under reservoir floor	900 c. y.	3.00	2.75	3
11. Reinforced concrete	1,170 c. y.	22.00	28.12	25
12. Plain concrete	115 c. y.	19.00	18.00	20
13. Galvanized iron water stops	4,200 l. f.	.80	.85	
14. Valve chamber, complete	Lump Sum	1,500.00	1,200.00	600
15. Collecting box, complete	Lump Sum	1,500.00	775.00	550
16. Roof, complete (incl. lumber, timber, hardware and roofing)	Lump Sum	20,424.00	21,335.40	21,020
17. Lay 24-in. c. i. pipe and fittings	100 l. f.	4.00	4.00	1
18. Lay 18-in. c. i. pipe and fittings	130 l. f.	4.00	3.00	1
19. Lay 16-in. c. i. pipe and fittings	64 l. f.	3.00	3.00	
20. Lay 6-in. c. i. pipe and fittings	155 l. f.	1.00	.75	
21. 24-in. o. d. welded steel pipe, incl. c. i. flange and welded conn. to 36-in. line	Lump Sum	500.00	338.00	190
22. Set 24-in. gate valve (furnished)	1 ea.	50.00	50.00	75
23. Set 16-in. altitude control valve	Lump Sum	150.00	40.00	75
24. Set 18-in. gate valve	Lump Sum	50.00	45.00	60
25. Set 4-in. gate valve	Lump Sum	10.00	5.00	40
26. Gravel on access road	250 c. y.	2.00	2.00	2
27. 15-in. b. & s. vit. pipe, cem. joints	227 l. f.	2.00	1.75	3
28. 8-in. vit. pipe, as above	210 l. f.	1.00	.80	1
29. Four-strand barb-wire fence	140 rod	2.00	2.50	3
30. Screen over outlet pipe	Lump Sum	50.00	35.00	100
31. Conc. gutters on north and south sides of reservoir for roof drainage and making pipe connection	Lump Sum	500.00	688.00	335
32. Asphalt and oakum in expan. joints	5 ton	100.00	100.00	50
33. Riprap at outlet to waste pipe	100 s. y.	5.00	3.00	1
34. 12-in. corr. iron pipe	50 l. f.	2.00	1.50	3
35. 1½-in. galv. iron pipe and fittings	Lump Sum	50.00	17.00	60
36. Cast iron frames and covers	3 ea.	30.00	39.00	37
37. Delivery of irrigation water	Lump Sum	100.00	50.00	100

HIGHWAYS, IDAHO

OWNER: Idaho Dept. of Public Works, Boise.

PROJECT: Constructing a plant mix bituminous surface on 11.203 miles of the Old Oregon Trail from Glenns Ferry westerly, and from King Hill to the Gooding County line; and on 6.086 miles of the Franklin Highway from Boise to Joplin Corner; and seal coat on 3.628 miles of the Old Oregon Trail from Bliss westerly, in Ada, Elmore and Gooding Counties, Idaho.

CONDITIONS: Contractor to furnish all materials and complete work by Oct. 15, 1943. Rail and highway transportation facilities available. Wage rates are: skilled labor, $1.10 per hour; semi-skilled, 90c.; and common, 75c.

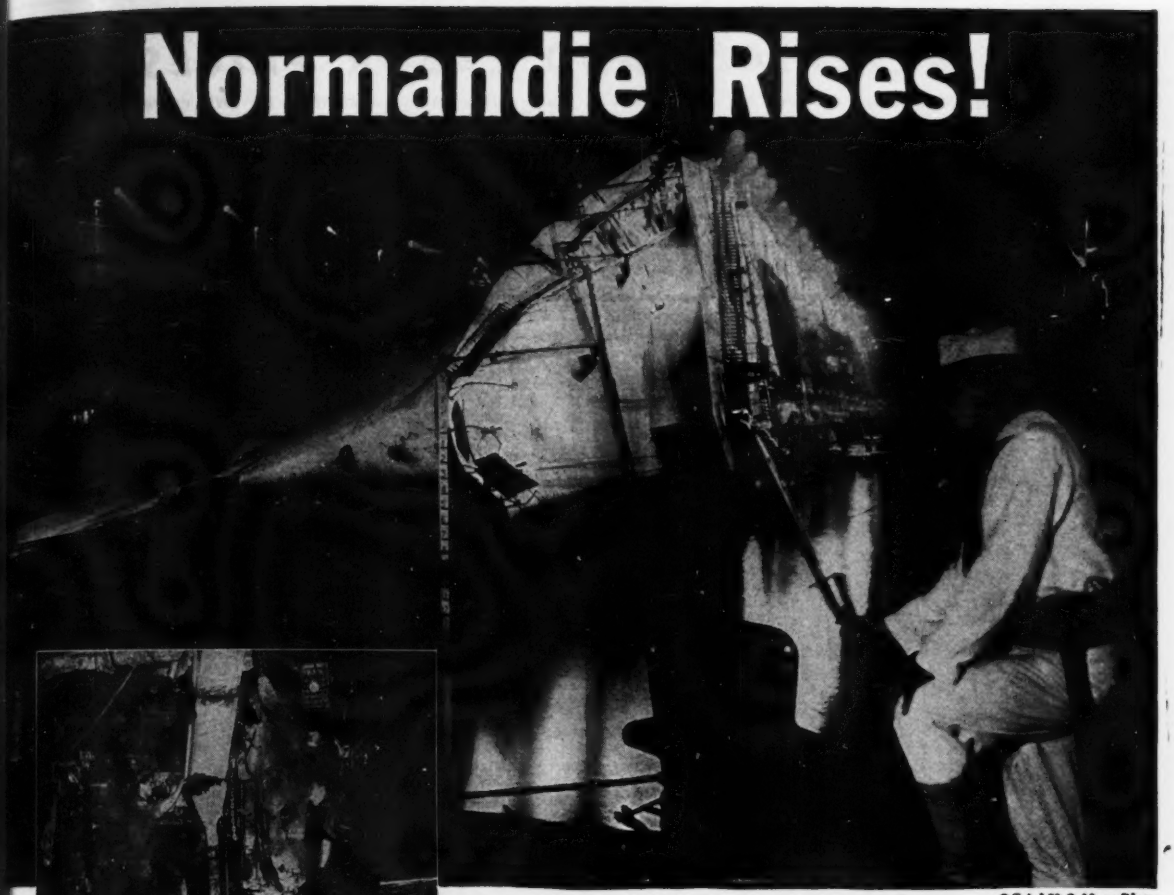
BIDS: Three bids were received July 23, 1943, ranging from the contract low of $133,404 to $162,450. Engineer's estimate, $153,614.

LIST OF BIDDERS:

1. Triangle Constr. Co., Boise, Idaho (contract) $133,404
2. S. Birch & Son, Great Falls, Mont 149,883
3. Hoops Constr. Co., Twin Falls, Idaho 162,450

Item	Quan.	Unit Prices (1)	(2)	(3)
1. Haul, on binder	3,000 mi. y.	$0.10	$0.21	$0
2. Crushed gravel surfacing for shoulders	20,300 ton	.50	.66	
3. Rolling, power roller	34 days	24.00	29.50	40
4. Watering, base and surf. course	310 M gal.	3.00	2.30	2
5. Binder	1,290 c. y.	.20	.54	
6. Liquid asphalt prime coat, MC-1	2,125 bbl.	4.50	6.50	4
7. 200-300 penet. asph. for plant mix	1,615 ton	23.50	32.40	26
8. Plant mix bituminous surfacing	32,300 ton	1.80	1.45	2
9. Liquid asphalt seal coat, MC-5	2,135 bbl.	4.50	6.52	4
10. Cover coat material type B	4,550 ton	1.25	1.35	1

Normandie Rises!



Official U. S. Navy Photos

Nearly 1,000 cu. yds. of concrete in bulkheads, placed under water, stiffened the hull and helped control de-watering.

Concrete Bulkheads Help Lick Biggest Salvage Problem

THE Normandie is back on her sea-legs . . . soon she'll be at a fitting-out dock . . . then, before many months, to sea again! Score another triumph for the Navy . . . and the Navy's Salvage Service . . . in raising the 80,000-ton vessel with her own buoyancy, by removing over 100,000 tons of water and debris. This tremendous weight could easily have burst her sides or broken her back. Nearly 1,000 cu. yds. of concrete were tremied into place in bulkheads used to stiffen the hull and help control buoyancy while de-watering. Strong, dense, watertight concrete . . . standby in marine service . . . helped solve this toughest of salvage problems.

We are proud to have had the opportunity to serve the Navy by furnishing Lone Star Cements for a substantial part of the concrete work on the Normandie.

LONE STAR CEMENT CORPORATION

Offices: ALBANY • BIRMINGHAM • BOSTON • CHICAGO • DALLAS • HOUSTON • INDIANAPOLIS • JACKSON, MISS. KANSAS CITY, MO. • NEW ORLEANS • NEW YORK • NORFOLK • PHILADELPHIA • ST. LOUIS • WASHINGTON, D. C.

LONE STAR CEMENT, WITH ITS SUBSIDIARIES, IS ONE OF THE WORLD'S LARGEST CEMENT PRODUCERS, 15 MODERN MILLS, 25-MILLION BARRELS ANNUAL CAPACITY

MATERIALS AND LABOR PRICES

Market quotations on construction materials and wage rates reported monthly by ENR correspondents

LUMBER PRICES continue to provide the most important price changes in the construction material list for September. Short-leaf Southern pine is up in Baltimore, Chicago, Cleveland, Detroit, Kansas City, Philadelphia, and on 1-in. boards in New Orleans. On 2-in. boards, however, pine is lower in New Orleans. Douglas fir is higher on 2-in. sizes in Baltimore, and is up in Kansas City, Los Angeles, Minneapolis and Philadelphia. It increased on 1-in. sizes in San Francisco, but decreased on all other quoted sizes.

Cement is 19c. per barrel higher in San Francisco, and up 1c. in Pittsburgh. Sand and gravel has climbed in Detroit, but is lower in Pittsburgh. Structural steel and reinforcing steel continue unchanged.

CEMENT, AGGREGATES, READY-MIXED CONCRETE—F. O. B. CITY

	PORTLAND CEMENT — Per bbl., C/L lots, incl. 40c per bbl. for bags, cash dis. not deducted			SAND AND GRAVEL — Per ton, carload lots			CRUSHED STONE — Per ton, carload lots		CRUSHED SLAG — Per ton, carload lots, f.o.b. plant		CONCRETE BLOCK 8x8x16-in.; truckload del.; per block		CONCRETE Ready Mixed 1:2:4, cubic yd. del.
	Cloth a	Paper	Bulk	Gravel, 1½ in.	Gravel, ¾ in.	Sand	1½ in	¾ in.	1½ in.	¾ in.	Sand-grav.	Lt. wgt. Agg.	50 c.y. or more
Atlanta	$2.77	$2.52	$2.47	$1.70	$1.80	$1.90	$1.70	$1.80	$1.50	$1.60	$0.16	.....	$8.00
Baltimore	2.33	2.08	1.88	1.75‡	1.75‡	1.25‡	1.75‡	1.75‡	1.75‡	1.75‡	.125	$0.125w	7.25
Birmingham	2.50	2.25	2.10	1.75	1.75	1.50	.85	1.00	.90	1.15	.1425	.....	5.90
Boston	2.75b	2.40b	2.30	1.40‡	1.40‡	1.00‡	1.40‡	1.40‡	....	....	.165	.165w	7.25m
Chicago	2.70	2.45	2.30	2.15‡d	2.15‡d	2.15‡d	2.15‡d	2.15‡d	1.75‡	1.75‡	16	.16z	....
Cincinnati	2.31	2.06	1.81	1.20	1.20	1.10	1.80	1.80	....	....	.12	.15w	6.60
Cleveland	2.40	2.15	....	1.70i	1.70i	1.60i	1.70i	1.70i	1.75i	1.75i	.14	.14	7.30i
Dallas	2.52	2.27	2.07	1.50p	1.70p	1.10p	1.69p	1.79p	....	....	.15	.....	6.20
Denver	3.08	2.88	2.68	1.20	1.40	1.25	1.65	1.75	1.00	1.00	.15	.15w	7.25
Detroit	2.39	2.14	1.99	2.25	2.25	2.00	2.25	2.25	2.00‡	2.25‡	.16	.18w	6.50
Kansas City	2.58	2.33	2.18	1.85	2.30	1.00	1.91	1.91	....	....	.125	.125ey	7.50n
Los Angeles	2.80e	2.70e	....	1.30	1.30	1.15	1.30f	1.30f	....	....	.04bb	.10aa	7.25
Minneapolis	2.90	2.65	....	1.00h	1.00h	.25h	1.00h	1.00h	....	....	.12	.16	7.10j
Montreal	....	1.95r	1.70r	....	1.65‡	2.05‡	1.05‡	1.15‡	....	....	.14c	.14uc	7.90u
New Orleans	2.41	2.16	1.96	1.65	1.65	.90	....	....	....	....	.19	.....	9.25
New York	2.69‡	2.44‡	....	1.60de	1.60de	.90de	1.70de	1.80de	....	....	.14cc	.14wcc	7.80k
Philadelphia	2.33	2.08	1.88	1.55‡	1.65‡	1.20‡	1.90	1.95	1.10	1.10	.155	.155w	8.20
Pittsburgh	2.45	2.20	2.00	1.15‡	1.15‡	1.45‡	2.25‡	2.25‡	1.50	1.50	.17	.17s	8.25
St. Louis	2.80	2.52	....	1.75‡	1.50‡	1.25/1.50‡	1.10h	1.10h	.75g	.75g	.125	.105w	8.00
San Francisco	....u	2.41	2.11	1.36	1.36	1.36	1.46	1.46	....	....	....	.20aa	7.55
Seattle	2.95e	2.75e	....	1.00e	1.00e	1.00e	2.00e	2.00e	....	....	.16	.16y	7.25

‡ Delivered. a 10c. allowed for each returnable bag. b 10c. per bbl. off for cash. c Plus municipal tax. d Per cu. yd. e Barge lots alongside docks. f Crushed granite. g F.o.b. Granite City, Ill. h F.o.b. plant. i Within three miles of Public Square. j 5% discount for cash. k Discount of 2 percent for cash in 10 days. l Up to 200 cu.yd. m 50c. off for cash. n 25 c.y. or more. o 2% off for cash. p 10c. per ton off, cash 15 days. r 10c. per bbl. off, cash 20 days. s 8% sales tax included. t 8% sales tax not included. u Price withdrawn. v 20c. per bbl. discount; 20c. allowed for returnable cloth bag. w Cinder. x Waylite. y Haydite. z Celocreta. aa Pumice. bb 4 x 8 x 12 n. cc Also 8 x 12 x 16 in.

CASH DISCOUNTS CEMENT to Contractors: truck delivery, 2% for cash on 10th of month: on carload deliveries, no trucking, same as dealer cash discount 10c. per bbl. for payment within 15 days of date of invoice. Subject discount 10c. per bbl. 20 days in Montreal.

CURRENT MAXIMUM PRICES RECEIVED AT CEMENT MILL

Charge for bags not included. For cloth bags, add 40c. per bbl.; 10c. refund allowed for each returnable bag; for paper bags add 15c. per bbl., not refundable.

	Bagged	Bulk		Bagged	Bulk		Bagged	Bulk
Buffington, Ind.	$1.70	$1.65	Ironton, Ohio	$1.60	$1.55	Richard City, Tenn.	$1.80	$1.75
Dallas, Tex. (Inc. 9c. tax)	1.84	1.79	Limedale, Ind.	1.70	1.65	Steelton, Minn.	1.80	1.75
Hannibal, Mo.	1.70	1.65	Norfolk, Va	1.75	1.70	Universal, Pa.	1.65	1.60
Hudson, N. Y.	1.75	1.70	Northampton, Pa.	1.55	1.50	Waco, Tex. (Plus 9c. tax in Tex.)	1.73	1.70
Independence, Kans.	1.70	1.65	North Birmingham, Ala.	1.70	1.65	Montreal (8% sales tax incl.). Discount 10c per bbl. 20 days	1.68	1.63

PAVING BRICK, BLOCK, ASPHALT, ROAD OILS—F. O. B. CITY

	PAVING BRICK AND BLOCK — Granite per M. lots of 50,000 4x4x8 in.	Brick per M. 3½x8½ in. carload lots	Wood per sq. yd. 3½ in. 16-lb. treat	PAVING ASPHALT — Per ton, less than 80 penetration: Tank car	Drums	ASPHALT BINDERS—FLUXES — Per gal., 80–300 penetration: Tank car	Drums	CUTBACK ASPHALT — Per ton: Tank car	Drums	ROAD OIL — Per gal.: Tank car	ASPHALT EMULSION (Quick-breaking) Per gal.: Tank car	Drums
Atlanta	$73.00	$39.35	$2.25	$18.40e	$24.62e	$0.0787e	$0.1309e	$0.0876hr	$0.1348h	$0.0676e	$0.0826	$0.1394
Baltimore	150.00‡	48.00	80.00m	15.00r	21.00r	.06r	.09r	13.00r	23.00r	.065r	.07r	14r
Birmingham	150.00	48.00;	.....	17.95	.....†	.0747	.....†	.0834h	.....†	.065	.09	.....
Boston	80.00	57.00	3.75	14.20	20.00	.06	.09	.065h	.115h	.065	.09‡	.12‡
Chicago	150.00	55.00	1.80/2.00d	14.00	22.50	13.00g	21.50g	.0575h	.15h	.05n	.09/.10n	.13/.15n
Cincinnati	120.00	50.00	.....	16.40	.....	.065	.....	12.25	.....	.07	.085	.....
Cleveland	118.00	37.50	2.25	19.00	20.00	.09	.105	.10h	.15	.105	.09	.094
Dallas	.....	36.00	.....	13.65	20.30	.06	.11	16.00	24.80	.06	.05/.07	.07/.09
Denver	.....	27.50	.....	11.00	.....	10.00	.....	.0475h	.....	.....	.....	.....
Detroit	.....	37.50	.....	15.06r	25.60f	.0743	.128	.0718h	.119h	.067	.0755	.1149
Kansas City	.....	40.00	.....	16.50	23.50	.077	.1075	.077h	.107h	.057	.11	.15
Los Angeles	.....	50.00	.....	9.00b	23.00	9.50bg	24.00bg	9.50b	.....	.025	.072	.18
Minneapolis	.....	.....	2.30d	.....	27.70	.....	126	.....	32.64	.....	.....	.....
Montreal	.....	.....	.....	16.60k	24.25k	.116k	.1485k	.115hk	.135hk	.08k	135k	.188k
New Orleans	.....	.....	.....	13.50a	20.00a	.057	.088	.06h	.095h	.....	.080	.....
New York	.....	70.00	.....	17.40	24.20p	14.00	.....	.0725h	.1325hp	.....	.0725p	.1225p
Philadelphia	140.00	58.00	4.06	15.00r	.....	14.00r	.....	.065hr	.....	.....	14.00gr	.....
Pittsburgh	135.00	38.75	.....	18.00	23.00	.09	.16	20.00	36.00	.07	.06	11
St. Louis	.....	37.00	.....	16.00	22.00	15.00g	21.00g	.0575h	.1213h	.048	.0525	.1125
San Francisco	.....	40.00	.....	10.90	21.15	10.90gr	18.00gr	12.90	17.50r	9.50gr	.0525	.1125
Seattle	.....	60.00c	.....	10.90i	19.40i	.....	20.40gi	11.40i	.....	10.90i	.0525i	.0825i

‡ Delivered. a F.o.b. Baton Rouge. b Delivered to purchaser's warehouse. c 3½x4x8½ in. d 2½ in. 12-lb. treatment. e Local reduction due to 20% reduction intra-state class freight rates, only Georgia affected. f Mexican. g Per ton. h Per gallon. i F.o.b. Martines. j 3x3½x8½ in. k Tax included. m Per thousand. n Available on priority only and quoted specially. p No steel drum shipments except to armed forces. r February 1943 prices, none later available.

New Engineering Books

(Continued from page 112)

PERVISION OF GOVERNMENTAL EMPLOYEES—By Alfred M. Cooper. 196 pp. McGraw-Hill Book Co., Inc., New York and London. $1.75.

ANSPORT FOR WAR—By Edward Hungerford. 268 pp. E. P. Dutton & Co., Inc., New York. $3.

CRETARY TO THE ENGINEER—By Queena Hazelton. 309 pp. McGraw-Hill Book Co., Inc., New York and London. $1.75.

Reports and Pamphlets

ALTH DIGEST – 1942 — Department of Health, Montclair, N. J.

LWAUKEE'S PROGRESS, 1942—22nd Annual Consolidated Report of Common Council, Milwaukee, Wis.

CHIGAN STREAM CONTROL COMMISSION—Sixth Biennial Report, 1941–1942. Lansing, Michigan.

ATER COMMISSIONERS—Sixty-ninth Annual Report, 1942. Springfield, Mass.

UR CITY GOVERNMENT—Schenectady, N. Y.

ARD OF ROAD COMMISSIONERS of the County of Wayne, Michigan, 36th Annual Report. Detroit, Mich.

NFERENCE ON WAR AND POSTWAR HIGHWAY PROBLEMS—University of Tennessee, Knoxville, Tenn.

UNICIPAL PUBLIC WORKS SERVICE EXPENDITURES AND APPROPRIATIONS—American Public Works Association, Chicago, Ill. $1.50.

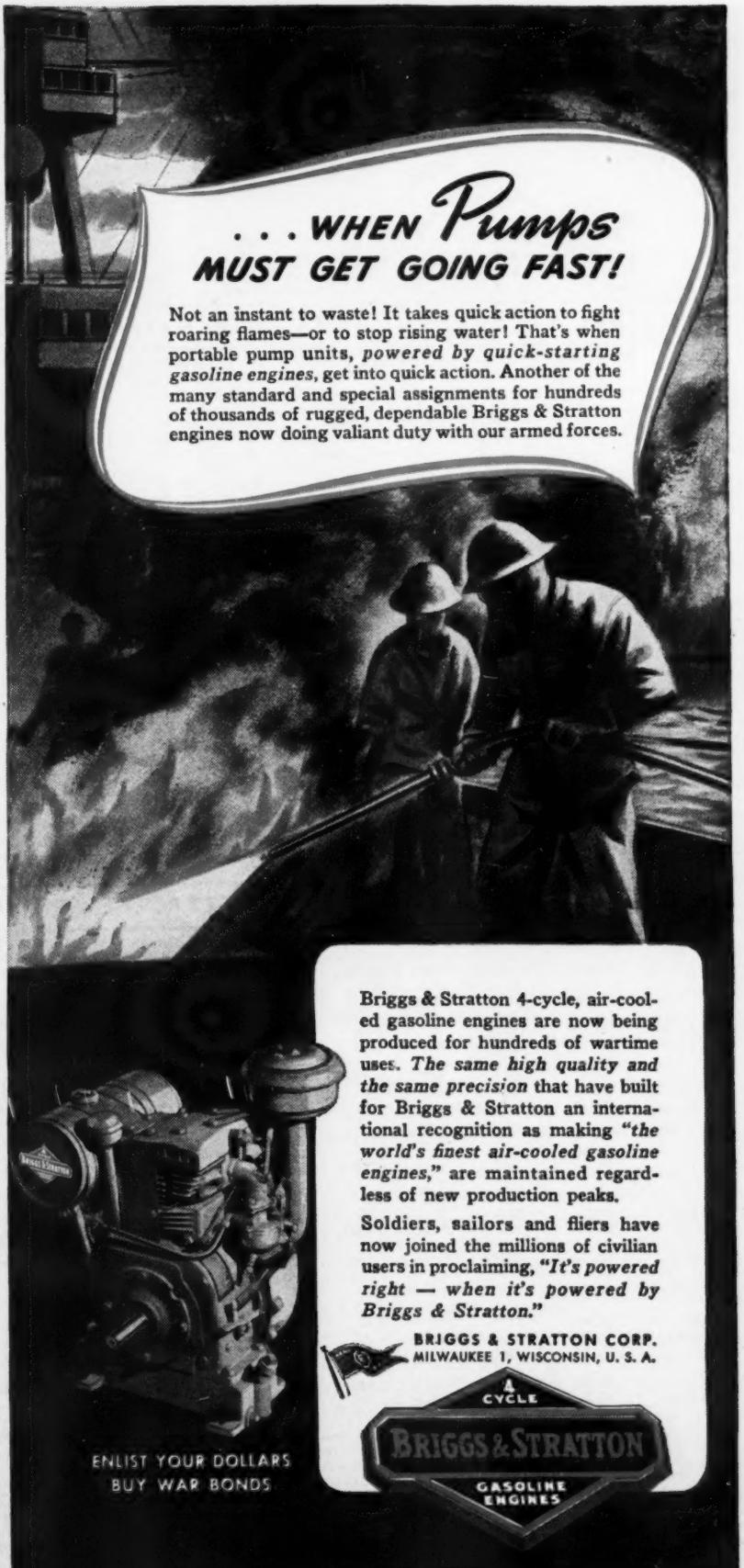
OCEEDINGS OF THE SIXTH TEXAS CONFERENCE on Soil Mechanics and Foundation Engineering. University of Texas, Austin, Texas. $2.

OCEEDINGS OF THE TWENTY-NINTH ANNUAL HIGHWAY CONFERENCE—University of Michigan Official Publication, Vol. 44, No. 101. Ann Arbor, Mich.

ILROADS IN TWO WARS—Association of American Railroads, Transportation Bldg., Washington, D. C.

E. JOURNAL—Chinese Institute of Engineers, America Section. Vol. 1, No. 1, Room 1215, 119 W. 57th St., New York, N. Y.

E PERCENTAGE STRESS-STRAIN DIAGRAM as an Index to the Comparative Behavior of Materials Under Load—Bulletin 159. Iowa Engineering Experiment Station, Ames, Iowa.


. . . WHEN Pumps MUST GET GOING FAST!
Not an instant to waste! It takes quick action to fight roaring flames—or to stop rising water! That's when portable pump units, powered by quick-starting gasoline engines, get into quick action. Another of the many standard and special assignments for hundreds of thousands of rugged, dependable Briggs & Stratton engines now doing valiant duty with our armed forces.
Briggs & Stratton 4-cycle, air-cooled gasoline engines are now being produced for hundreds of wartime uses. The same high quality and the same precision that have built for Briggs & Stratton an international recognition as making "the world's finest air-cooled gasoline engines," are maintained regardless of new production peaks.
Soldiers, sailors and fliers have now joined the millions of civilian users in proclaiming, "It's powered right — when it's powered by Briggs & Stratton."
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BRIGGS & STRATTON
GASOLINE ENGINES
ENLIST YOUR DOLLARS
BUY WAR BONDS

IRON AND STEEL PRODUCTS—BASE MILL PRICES

	STRUCT. SHAPES-PLATE	REINF. BARS ¼-in billet *b*	RIVETS ½-in. structural	WIRE NAILS Base *d*	SHEET PILING Base	STEEL RAILS Per Gross Ton: Standard	Light	Re-rolled	TRACK SUPPLIES: Angle Bars	Std. Spikes *c*	Tie Plates *c*	Track Bolts
Birmingham	$2.10	$2.15	$3.75	$2.55	$2.40	$40.00	$40.00	$39.00	$2.70	$3.00	$2.15	$4.75
Chicago	2.10	2.15	3.75	2.55	2.40	40.00	40.00	39.00	2.70	3.00	2.15	4.75
Pittsburgh	2.10	2.15	3.75	2.55	2.40	40.00	40.00	39.00	2.70	3.00	2.15	4.75
Buffalo	2.10	2.15	.....	.....	2.40	.....	.....	.....	.....	.....	2.15	.....
Cleveland	2.10	2.15	3.75	2.55	.....	.....	.....	.....	.....	.....	.....	.....
Youngstown	.....	2.15	.....	.....	.....	.....	.....	.....	.....	3.00	.....	.....
Detroit	.....	2.27‡	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Gulf ports	2.47*a*	2.52*a*	.....	.....	2.85*a*	.....	.....	.....	.....	.....	.....	.....
Pacific ports	2.75*a*	2.80*a*	.....	.....	2.95*a*	.....	.....	.....	.....	.....	2.30	.....

‡ Delivered. *a* F.o.b. cars dock. *b* Rail steel same as billet prices. *c* Other basing points include Portsmouth, O., Weirton, W. Va., St. Louis, Kansas City, Minnequa, Colo., and Pacific coast ports, on tie plates alone, Steelton, Pa., on spikes alone, Lebanon, Pa., Richmond, Va. *d* Add switching charge $18 per c.

IRON AND STEEL PRODUCTS—F.O.B. WAREHOUSE, PER 100 LB., BASE PRICE

	STRUCTURAL SHAPES Per 100 lb. base price	REINFORCING BARS* Per 100 lb., ¼ in., base price: 15 tons or over *b* New billet	Rail steel	Add Switch	$/cwt. for Del.	EXPANDED METAL LATH Per 100 sq.yd., carload lots: Std. diamond mesh, 3.4 lb	Std. ribbed 3.4 lb.	WELDED FABRIC REINFORCING: Per 100 sq.yd., carload lots: 4x16 in., No. 5 & 10 wires	4x12 in., No. 8 & 12 wires	6x6 in. No. 6 & 6 wires Per sq. yd.	SHEET PILING Per 100 lb. base price
Atlanta	$2.34	$2.39	$2.39	$.02½	$.10	$21.06	$23.00	$1.82	$1.35	$0.1719	$3.04
Baltimore	3.70	2.90	2.75	.....	.10	22.50	24.50	1.70	1.27	.1611	3.00
Birmingham	2.10*a*	2.15	2.15	.02½	.10	19.00	21.00	1.80	1.34	.1701	.....
Boston	3.85	3.51	3.36	$20 C.L.	.10	18.50	29.50	1.76	1.31	.1656	2.70
Chicago	2.10*a*	2.15	2.15	.03	.05	21.50	23.50	1.67	1.25	.1575	2.60
Cincinnati	3.68	2.53*cd*	2.53*cd*	.....	.05	19.50	21.50	1.66	1.25	.1566	.....
Cleveland	2.10*a*	2.15	2.15	.02½	.10	19.50	21.50	1.66	1.25	.1566	.....
Dallas	4.25	3.17	3.17	.....	....	25.00	27.50	1.93	1.42	.1827	.....
Denver	4.35	3.95	3.85	.....	....	26.50	28.50	1.97	1.45	.186	.....
Detroit	3.65‡	2.52‡	2.52‡	.....	.10	26.00	30.00	1.68	1.26	.1584	2.66
Kansas City	4.00	2.61*cd*	2.61*cd*	.0	.05	24.50	26.50	1.78	1.33	.1683	2.87*h*
Los Angeles	3.65*f*	2.575	2.425	.02½	.05	23.00	27.50	1.93	1.42	.1827	3.05
Minneapolis	3.81‡	2.73	2.73	.0	.10	25.00	27.00	1.80	1.34	.1701	2.73*d*
Montreal	4.00*i*	2.90*i*	2.80*i*	.....	....	26.00*hij*	33.00*hij*	2.56*i*	3.14*i*	.268*i*	.....
New Orleans	4.40	2.52	2.52	.05	.10	21.50	23.50	1.82	1.35	.1715	2.87*h*
New York	3.75	2.76*e*	2.76*e*	.	.15	17.50	19.50	1.76	1.32	.1665	2.74
Philadelphia	3.66	3.82	....	.	....	19.50	21.50	1.71	1.28	.1611	2.72
Pittsburgh	2.10*a*	2.15	2.15	.	.10	23.00	26.50	1.59	1.20	.1503	2.40
St. Louis	3.69*f*	2.74	2.74	.0	.05	28.00	34.00	1.69	1.27	.1602	2.70
San Francisco	4.35	2.825	....	.02½	.10	21.00	24.50	1.93	1.42	.1827	3.85
Seattle	2.75*e*	2.80*e*	....	.....	....	34.50	38.50	1.93	1.42	.1827	2.95*d*

‡ Delivered. *a* Mill prices. *b* 5–15 tons, add 15c. 1–5 tons, add 25c. Less than 1 ton, add 50c. *c* 20 tons or over Base. *d* Mill price plus freight. *e* F.o.b. dock. *f* Includes delivery in free delivery zone. *g* Less than 1 ton, add 25c.; 1 to 5 tons, add 10c. * High scrap steel prices cut former 15c. differences between new billet and rail steel in many mills. *h* List price. *i* Plus Dominion and Province sales tax. *j* August 1942 price; not on market.

PLUMBING, HEATING, WATER, SEWER AND DRAIN PIPE

	C. I. PIPE Per net ton f.o.b. 6 in. to 24 in.*a*	VITRIFIED SEWER PIPE: Per foot, std. 8 in., s.s.	Delivered std. 12 in., s.s.	ASTM 24 in.,	C13–35 36 in.,	CLAY DRAIN TILE Per 1,000 ft., carload lots, f.o.b.: 6 in.	8 in.	CONCRETE SEWER PIPE Per ft., delivered; ASTM C 14–35: 12 in.	24 in.	WROUGHT STEEL PIPE Full standard weight, *h*: 1 to 3 in., Black %	Butt Weld 3½ to 6 in.; Galv. %	Black %	Lap Weld Galv. %
Atlanta	$49.66	$0.265	$0.4685*c*	$1.8525	$4.68*c*	$85.00	$128.00	$0.45	$1.642	48.2	54.2	59.7	51.2
Baltimore	53.00	.35	.60	2.65	7.25	160.00	200.00	.50	1.75	65.5	57.5	63.0	54.5
Birmingham	45.00	.275	.495	1.95	5.50	100.00	220.00	.50	1.70	62.2	54.2	59.7	51.2
Boston	55.40	.26	.463	2.07	5.85	140.00	.....	.60	.....	....	....	....	....
Chicago	54.33	.35	.675	2.70	7.00	100.00‡	150.00‡	.45	1.85	66.0	55.0	64.5	53.0
Cincinnati	53.27	.231	.4455	1.80	5.125	105.00	170.00	.60	1.70	57.1	43.4	54.0	39.6
Cleveland	54.75	.196	.378	1.62	4.715	81.00	125.00	.30	1.60	68.5	57.5	66.0	54.8
Dallas	56.43	.31	.58	2.25	5.00	90.00	110.00	.46	1.57	59.9	51.9	57.3	48.3
Denver	61.56	.29†	.52†	2.16†	3.00*m*	130.00	240.00	1.00	2.22	58.4	50.4	55.7	47.2
Detroit	54.75	.35	.675	2.70	7.75	100.00	175.00	.40	1.75	57.7	44.0	54.8	40.6
Kansas City	55.73	.315	.39	2.20	5.86	140.00	260.00	.45	1.60	35.6	46.1	46.2	39.4
Los Angeles	68.40	.282†	.508†	2.034†	5.085†	115.50	192.50	1.00	2.00	61.1	50.1	58.6	47.1
Minneapolis	59.00	.275†	.495†	1.98†	5.37†	.....	.....	.90	2.10	64.2	53.2	60.7	49.2
Montreal	60.00	.85*o*	1.50*o*	5.25*p*	8.50*ep*	45.00*m*	64.00*m*	.48*m*†	1.92*m*†	....	....	....	....
New Orleans	51.78	.26	.48	1.69	.....	150.00	220.00	.45	1.65	62.4	54.4	58.8	50.3
New York	52.40	.322	.621	2.43	6.15	.....	.....	.60	1.40	64.9	53.9	62.4	50.9
Philadelphia	51.00	.30	.58	2.50	7.50	150.00	225.00	.45	1.75	56.6	42.8	53.6	39.1
Pittsburgh	56.00	.245†	.4725†	1.845†	5.4325	97.80	154.20	.85*g*	2.00*g*	68.5*i*	57.5*i*	66.0*i*	54.5*i*
St. Louis	52.84	.28	.504	2.016	4.50	85.00	220.00	1.00*j*	2.15*k*	56.4	42.6	52.5	38.4
San Francisco	68.40	.3525*d*	.6525*d*	2.61	6.52	115.00	192.50	.58	2.34	45.0	31.0	41.0	28.0
Seattle	70.20	.375	.675	2.70	6.75	84.00	187.50	.51*f*	1.44*f*	....	....	....	.....

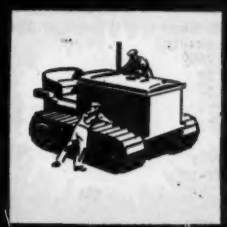
‡ Delivered. †F.o.b. *a* B. & S. class B and heavier, C/L lots, 200 tons and over Burlington, N.J. (base) $49.00. Based on existing freight rates; subject to rate change. Gas pipe and class A, $3 per ton additional, 4 in., $3 per ton additional, 30 in. and larger usually $2 per ton less. *b* Double strength. *c* List to dealer. *d* List. *e* 30-inch. *f* Less 5% for cash. *g* Culvert pipe. *h* Discounts from standard list consumers carload prices, except Pittsburgh prices are f.o.b. mill. Base price $200 per net ton. List prices per ft.; ½ in., 8½c.; ¾ in., 11½c.; 1 in., 17c.; 2 in., 37c.; 2½ in., 58½c.; 3 in., 76½c.; 4 in., $1.09; 6 in., $1.92. 3 percent tax on transporation costs not included. *i* Applies also at Lorain, Ohio, mills. Chicago delivered base is 2½ points less on butt, 1½ on lap. Freight is figured from Pittsburgh, Lorain, O., Chicago Dist. Billing is from point producing lowest price at destination. WROUGHT IRON PIPE: Base price and list prices per ft. same as wrought steel pipe. Discount for Pittsburgh base: Butt-weld—1 in. and 1¼ in. black 34, galv. 16; 1½ in. black 38, galv. 18½; 2 in. black 37½, galv. 18. Lapweld—2½ in. to 3½ in. black 31½, galv. 14½; 4½ in. to 8 in. black, 32½ galv. 17. *j* Reinforced; spec. C 76–37. *k* Reinforced; spec. C 75–37. *l* Plus sales tax. *m* Tax included. *n* 27-in. pipe. *o* Less 50%. *p* Less 53%.

ı can buy a new
t in 3 minutes...

but it may take weeks
to replace a worn cam

e answer is
eventive Maintenance
y with Shell
sel Lubricants

SHELL



UNNECESSARY wear of cams due to improper lubrication prevents valves from seating properly, causing power loss, and eventually an idle engine. Waiting for replacement parts today, when it's more vital than ever that every piece of equipment be functioning 100%, is a spot in which no operator wants to find himself.

Many of these costly delays can be prevented by proper attention to lubrication. This includes a more careful selection of lubricants . . . more frequent check-ups. These more frequent check-ups may take a little longer, but those few extra minutes spent now will pay you big dividends in the time and money they'll save you later.

Don't wait for trouble to remind you that you should gear your maintenance procedure to war time tempo. Call in the Shell man now—let him help you plan your Preventive Maintenance.

First oil refinery to win Army-Navy "E"— Shell's Wood River Refinery

SHELL DIESEL LUBRICANTS
AND SHELL "DIESELINE"

LUMBER, TIMBER PLYWOOD—PER M FT., B.M., CARLOAD LOTS F.O.B.

	SHORT LEAF YELLOW PINE AND DOUGLAS FIR — All S. L. Y. P. is No. 2 common or better and for No. 1 N. C. Box. (Prices in Bold Face)									LONG LEAF Y. P. Merchantable grade up to 20 ft.		PLYWOOD Rail freight increment (See note for base price)	
	All Fir planks No. 2 common, Fir timber is No. 1 common. Lengths up to 20 ft. (Prices in italics)												
	1x6 S4S	1x8 S4S	2x4 S4S	2x6 S4S	2x8 S4S	2x10 S4S	3x12 Rgh	6x12 Rgh	12x12 Rgh	2x12 Rgh	12x12 Rgh	½"	¼"
Atlanta	$37 00	$37 00	$32 00	$31 00	$31 00	$34.50	$49.00	.....	.....	$58.00	$66.00	$17.90	$21.45
Baltimore	42 00	45 00	42.00	42.00	43 00	48 00	65.00	.....	.....	115.00	120.00	18.25	22.25
	48 00	*48.00*	*55.00*	*55.00*	*55.00*	*55.00*	*68.00*	*$70.00*	*$70.00*	.....	.....	.....	.....
Birmingham	34 50	36.50	32.00	32.00	34.00	34.00	53.00	53.00	56.00	.....	.....	17.35	21.15
	37.50	37.50	37.00	37.00	37.00	43.00	65.00	.....	.....	67.50	70.00	.....	.....
Boston‡*	42 00[b]	45 00[b]	55.00[b]	60.00[b]	60.00[b]	65.00[b]	75 00[b]	.....	.....	80.00[b]	.....	18.25	22.25
‡*	*50.00*	*50 00*	*55.00*	*60.00*	*65 00*	*70.00*	*80.00*	*85.00*	*85.00*	.....	.....	.....	.....
Chicago	47.00	48.00	44.00	43.00	44.00	45 50	64.00	.....	.....	80.00	95.00	14.60	17.80
	50.00	*50.00*	*47.50*	*47.00*	*47.00*	*48.00*	*67.00*	*66.00*	*68.00*	.....	.....	.....	.....
Cincinnati	41.00	42.50	39.00	40.50	42.00	43.00	53.00	.....	.....	65.00	68.00	17.35	21.15
	.....	.....	.....	.....	.....	.....	*55.50*	*55.50*	*55.50*	.....	.....	.....	.....
Cleveland	42.50*k*	42.50*k*	52.50*k*	51.00*k*	65.00	65.00	83.00	83.00	83.00	.....	.....	17.75	21.90
Dallas.....e	41.50	42.50	38.50	37.50	37.50	38.50	53.50	53.00	53.00	78.00	83.00	14.60	17.80
Denver‡	64 00[a]	62.00[a]	65.00[a]	65 00[a]	65.00[a]	65 00[a]	69 00[a]	*83.00*	*89.00*	.....	.....	10.45	12.70
Detroit	61.00	61.00	57.75	57.75	57.75	62 75	72 75	.....	.....	70.75	78.00	17.35	21.15
	.....	.....	.....	.....	.....	*63 75*	*71.00*	*75.00*	*75.00*	.....	.....	.....	.....
Kansas City..a	60.00	60 00	58 00	56 50	58.00	60.00	75.00	.....	.....	75.00	85.00	12.60	15.40
	60.00	*60 00*	*58.00*	*58.00*	*58.00*	*58.00*	*75.00*	*80.00*	*80.00*	.....	.....	.....	.....
Los Angeles....a	*58.50*	*58 50*	*58.50*	*59.00*	*60.25*	*60.25*	*75.75*	*74.25*	*74.25*	.....	.....	9.90*gh*	12.05*gh*
Minneapolis....b	59.00[a]	59.00[a]	.....	.....	.....	.....	.....	.....	.....	.....	.....	12.60	15.40
‡	*58.00*	*58.00*	*54.25*	*54.50*	*58.50*	*54.75*	*64.75*	*68.50*	*63.50*	.....	.....	.....	.....
Montreal.....†7	*58.00*	*56.00*	*48.00*	*52.00*	*54.00*	*60.00*	.....	.....	.....	200.00	200.00	.....	.....
	48.50	*48.50*	*45.25*	*45.25*	*45.25*	*48.75*	*50.00*	*50.00*	*50.00*	.....	.....	.....	.....
New Orleans	37 50	37.50	32.50	31.50	31.50	35.00	46.00	.....	.....	52.50	69.00	14.60	17.80
	51.00	*51.00*	*53.00*	*51.00*	*54.00*	*52.00*	*53.00*	.....	.....	.....	.....	.....	.....
New York.....‡*j*	60.50	61.50	56.25	55.25	56.25	59.50	67.50	.....	.....	120.00*f*	125.00*f*	18.35	22.25
‡	.....	.....	*65.00[c]*	*65.00[c]*	*65.00[c]*	*65.00[c]*	[Range from $75 to $95]			.....	.....	.....	.....
Philadelphia	63 00	63.00	62.00	61.00	61.00	64.00	84.00	.....	.....	126.00	122.00	18.25	22.25
	[*$70 00 to $85 00*]		75.00	75.00	75.00	75.00	77.50	*$85 to $105*	*$85 to $105*	.....	.....	.....	.....
Pittsburgh	50.80	53 20	62.75	55.00	60.85	62.50	76.25	.....	.....	.....	.....	18.10	22.05
	69 20	*68.10*	*66.10*	*65.30*	*65.20*	*65.65*	*88.75*	*88.75*	*88.75*	.....	.....	.....	.....
St. Louis.....‡*c*	56 00	52.00	53.00	52.00	53.00	56.00	69.00	75.00	75.00	86.00	85.00	14.60	17.80
San Francisco..*d*	*56.00*	*56.00*	*54.00*	*54.00*	*53.25*	*53.25*	*59.00*	*58.25*	*58.75*	.....	.....	7.30*g*	8.90*g*
Seattle	*55.00*	*55.00*	*55.00*	*55.00*	*55.00*	*55.00*	*40.00*	*40.00*	*40.00*	.....	.....	0.00	0.00

Bold Face type, Southern Pine. *Italics, Douglas Fir.* [1] Long leaf. [2] Roofers' N. C. Pine. [3] Spruce. [4] Native. [5] Western Pine, No. 3 Common. [6] Spruce. [7] Norway Pine. ‡ Delivered. *a* Yard prices. *b* Contractors discount in Minneapolis and St. Paul discontinued May 21, 1938. *c* 5M ft. or less. *d* F.o.b. cars San Francisco freight rate. *e* 10% discount taken off. *f* Up to 18 ft. † Plus sales tax. * Prices for truck delivery; no longer quoting carload lots f. o. b. city.

Note: Special concrete form grade Fir Plywood, 4' by 8' panels, 5-ply, sanded 2 sides, water resistant glue, carload lots, delivered per 1,000 sq. ft. surface. Seattle base price on ¾", $95.15; on ¼", $104.85; price includes oiling and sealing charges. For other centers add rail freight increment from table or proper size. For resin dipped treatment, add $10.50 per M. *g* Lower rate by water shipment. *h* 50,000 lb. minimum. *i* Ranges from $65 to $69. *j* Average price. *k* August price.

GLASS, EXPLOSIVES, CHEMICALS

	WINDOW GLASS — Discounts from jobbers list, Aug. 15, 1938 — Single or Double Thickness		EXPLOSIVES — Per lb. 40% Ammonia Gelatin in 50-lb. cases delivered in 200 lb. lots*	
	A quality	B quality		
Atlanta	75%	75%	$0.15	
Baltimore	78%	79%	.15	
Birmingham	76%	76%	.105	
Boston	77%	78%	.15	
Chicago	77%	77%	.15	
Cincinnati	77-10%	77-10%	.15	Price of 60% Ammonia Gelatin is $0.01 per lb higher than 40%
Cleveland	77-10%	77-10%	.19	
Dallas	76%	76%	.1625	
Denver	76%	76%	.155*e*	
Detroit	77%	77%	.1575	
Kansas City	76-10%	76-10%	.155	
Los Angeles	86%*d*	88%*d*	.1575	
Minneapolis	77%	77%	.155	
Montreal	40-5%‡	47%‡	.1675†	
New Orleans	70%	75%	.16	
New York	81%	82%	22*f*	
Philadelphia	78%	79%	.15	
Pittsburgh	79%	79%	1225	
St. Louis	77-10%	77 10%	155	
San Francisco	63%	73 %	155	
Seattle	75%	75%	.1575†	

a Disc. from list Sept. 1939. *b* Also less 6% tax exemption. *d* Discount from jobbers' list Sept. 15, 1928. ‡ Sales tax included.

* Urban prices influenced by service charges or local storage and delivery regulations, do not consistently reflect quantity prices in less congested areas. *e* F.o.b. Louviers, Colo. *f* In boroughs of Kings, Queens and Richmond, and in Manhattan south of Canal Street, add delivery charge of $6.00 per trip. † F.o.b.

40% Ammonia Gelatin price ranges in other than urban areas, per lb (except Seismograph Grades)

	C/L 20,000 lb. net	Tons	200 lb. lots
E. of the Miss., except Fla. and Me	$0.105	$0.13	$0.15
W. of Miss. to Rocky Mtn. States, Fla. and Maine	.11 -.1175	.135 -.1475	.155 -.1675
Rocky Mtn. States	.11 -.1225	.135 -.1525‡	.155 -.1725‡
Pacific N. W. States	.1075-.12	.1375-.15	.1575-.17
Pacific S. W. States	.1050-.1125	.135 -.1425	.155 -.1625

‡ F.o.b. Louviers, Colo., or Butte, Mont.

PILES, TIES—F.O.B.

PILES

Prices per linear foot, pine, with bark on, f.o.b. New York; delivered from barge 1½ to 2c. per ft. additional:

Dimensions	Points	Length	Short Leaf—Barge	Short Leaf—Rail
12 in. at butt	6 in	30 to 50 ft	...	$0.33
12 in.—2 ft. from butt	6 in	50 to 59 ft	...	.34
12 in—2 ft. from butt	6 in	60 to 69 ft	...	.35
14 in.—2 ft. from butt	6 in	50 to 69 ft	...	.40
14 in.—2 ft. from butt	6 in	70 to 79 ft	...	.41
14 in.—2 ft. from butt	5 in	80 to 85 ft.	...	.42
14 in.—2 ft. from butt	5 in	85 to 89 ft.	...	.44

RAILWAY TIES

Prices f.o.b., per tie for carload lots:		6"x8"x8' Untr.	6"x8"x8' Tr.	7"x9"x8'9" Untr.	7"x9"x8'9" Tr.
Boston	Oak	$1 50	....	$2.00	....
	Pine	2 00	$3.00*a*	2.50	$3.50*a*
New York	S. L. Sap Pine	1.43/1.54	2.59	1.78	2.88
	Mixed Oak	1.71	2.59	2.42	3.58
Birmingham	White Oak	1.00	1.60*a*	1.30	2.25*a*
	Southern Pine	....	....	....	....
Chicago	Red Oak	....	2.19*a*	....	2.87/3.00*a*
	Southern Pine	....	....	....	....
Los Angeles	Douglas Fir	1.10	1.75*a*	1.60	2.50*a*
Philadelphia	Red Oak	....	2.10*ag*	....	3.25*ag*
St. Louis	White Oak	1.48	....	2 04	....
	Red Oak	1.48	2.05*a*	2 04	2.83*a*
	Sap Pine or Cypress	1.35	....	1.91	....
San Francisco	Douglas Fir	1.25*bcf*	....	....	3.00*af*
Montreal	Birch or Maple	.85	.95	...†	...†

Tr.—Treated; Untr.—Untreated. *a* Creosoted. *b* 6"x8"x8'6". *c* Empty cell. *d* Zinc. *e* Green. *f* F.o.b. cars. † Out of market. *g* January price, none later available.

CHEMICALS

Water, sewage treatment, road work, f.o.b. carlots, New York

Bleaching powder, in drums, f.o.b. works, per 100-lb	$2.50- 3.10
Chlorine cylinders, liquid, per lb. delivered	.0525
Calcium chloride, 77–80%, flaked, in 100-lb. paper bags, delivered, per ton	18.50-35.00
Silicate of soda, 52 deg., in drums, f.o.b. works, per 100 lb	1.40
Soda ash, 58%, in paper bags, per 100 lb dense	1.15
Sulphate of aluminum, commercial, in 100-lb. bags, per ton	23.00-25.00
Sulphate of copper, in bbl., per 100-lb	5.00

NEW AIDS TO THE CONSTRUCTOR

Gas Mask

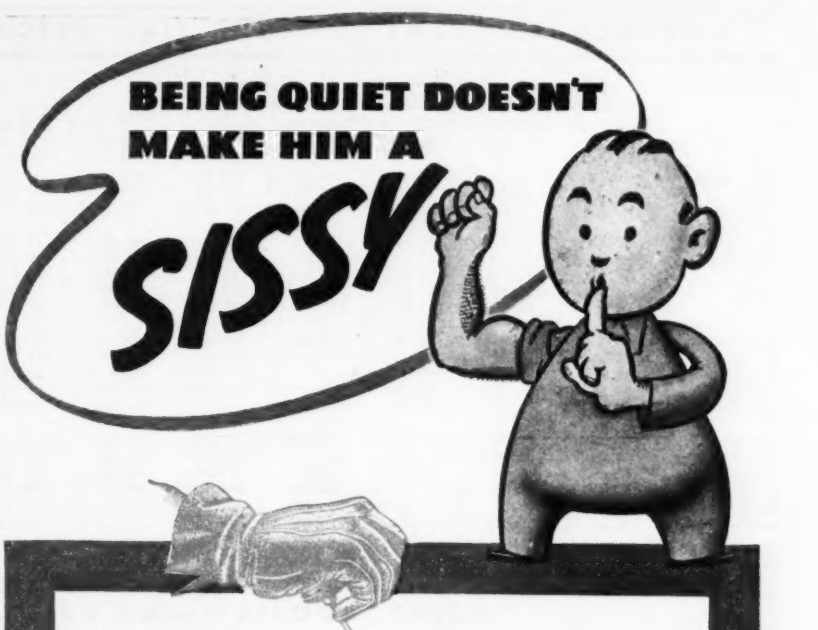
mplete protection against toxic s, fumes and smoke is claimed for a type of gas-mask, called "Protexall," h has been approved by the U. S. au of Mines. The facepiece, of spe- molded rubber, fits any face and s a gas-tight seal. The large, con- d lenses are shatter-proof, detach- and permit full vision; dry, incom- ir passing over them prevents fogg- Head harness of the mask is comfort- and adjusted by swivel buckles. The le exhalation valve has a metal d, but no seat to corrode or get out lignment. Other features of the mask the rugged, flexible tube to permit head movement and a safety timer. canister attached to the mask is said st approximately two hours and to a minimum of resistance to breath- with a filter and chemicals to absorb oisonous gases or make them harm- Each mask is supplied with a spare ter.—*American-La France-Foamite , Elmira, N. Y.*

Thermoplastic Tubing

nusual toughness and resistance to ture, brine and solvents characterize w flexible, semi-transparent thermo- ic tubing, called "Saran." This tub- the manufacturer states, may be used pplications previously requiring cop- except where high temperatures and high pressures are encountered. It also been found suitable to replace strategic metals and ceramics. This ic tubing may be used for short pe- s at 250 to 275 deg. F., although its gth and resistance are somewhat re- d at these temperatures.

is tubing, in sizes from ⅛ in. to

BEING QUIET DOESN'T MAKE HIM A SISSY



Because we have stressed *quiet running* as a prominent feature of Fuller Transmissions, don't get the idea that strength or ruggedness have been neglected . . . they haven't. From forgings to finished gears every precaution is taken: *first* in engineering design; *second* in the selection of materials; *third* in precision workmanship and close supervision . . . to assure you a transmission that will not only fully meet the ordinary working conditions to which a truck transmission is submitted; but to further assure a plus safety factor to guard against unusual demands. That's why you rightfully expect better performance and longer life from your Fuller Transmissions.

FULLER MANUFACTURING CO., KALAMAZOO, MICH.
Transmission Division

Unit Drop Forge Division, Milwaukee, Wis.

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BUILDING & BRIDGES
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HYDRAULIC ★ DIPPER
DERRICK BOATS
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AMERICAN STEEL DREDGE CO., INC.
Fort Wayne, Ind.
Write for Bulletin RD-102

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● Venturi Tubes, Weirs, Flumes, Nozzles and other primary elements; Mechanically and Electrically operated Registers and Complete Automatic Control Systems.

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Bailey Meter Co. Ltd., Montreal, Canada

STRUCTURAL CLAY BUILDING TILE, BRICK AND LIME—DELIVERED

	STRUCTURAL CLAY TILE—PARTITION—SCORED Per M. lots of 2,000 pieces or over. 3x12x12 in.	4x12x12 in.	8x12x12 in.	STRUCTURAL CLAY TILE—LOAD BEARING—SCORED Per M. lots of 2,000 pieces or over. 8x12x12 in.	10x12x12 in.	12x12x12 in.	BRICK Per M. in quantity. Common backing	Straight hard	LIME Per ton. Hydrated finishing	In paper, Common hydrated	Carload Pulverized or lump
Atlanta	$104.00	$114.00	$199.00	$234.00	$244.00	$320.00	$13.50	$18.04	$26.54	$15.04	$15.04
Baltimore	84.00	90.00	170.00	200.00	260.00	320.00	15.00*k*	19.00*k*	18.00	13.00	
Birmingham	80.00	85.00	160.00	191.00	252.00	288.00	14.50	17.00	18.11	13.64	
Boston	89.35*a*	93.30*a*	178.70*a*	202.50	271 80	308.20	16 50*i*	19.50*i*	17.50†	12.50†	
Chicago	72.00	77.00	145.00	197.00	243.00	278.00	12.50	13.50	17.00	15.00	
Cincinnati	65.55	69.90	131.20	148.70	210.35	240.45	17.50	17.50	15.50	13.00	
Cleveland	60.00	64.00	120.00	144.00	193.00	221.00	17.00	17.00	15.75*j*	13.25*j*	
Dallas	62.50	67.50	135.00	162.00	212.50	263.00	13.50*i*	15.00*i*	19.00	15.00	
Denver	84.80	95.40	153.70	178.20	212.00	227.90	14.50	17.00	25.00*j*	17.00*j*	
Detroit	86.05	91.80	172.10	213.00	268.00	330.00*e*	20.00	21.00	18.00	16.00	
Kansas City	67.00	69.00	89.00*c*	128.00	163.00	189.00	15.00	16.00	19.32	13.00	
Los Angeles	73.50†*r*	89.50†*r*	128.00*c*†*r*	210.00†*r*	368.00†*r*	460.00†*r*	13.50	15.00	16.50	17.50	
Minneapolis	81.95*b*	87.40*b*	148.70*b*	.....	179.30*b*	249.35*b*	13.60	15.60*g*	21.00	16.00	
Montreal	99.10*a*	105.65*a*	154.75*a*	104.65*at*	154.75*au*	155.25	24.16†*u*	27.25†*u*	24.60*u*	18.00*u*	
New Orleans	72.00	72.00	135.00	162.00	210.00	260.00	14.00	.....	18.30	12.08	
New York	78.40	83.60	115.00*c*	193.30*h*	238.80*h*	295.60*h*	16.00/17.00	.....	20.00	14.00	
Philadelphia	85.30	91.00	170.50	186.30	235.00	261.10	17.00	20.00	19.00	13.00	
Pittsburgh	62.36	66.55	124.75	140.25	173.25	198.00	17.50	19.50	17.90	15.40	
St. Louis	67.00	95.00	130.00	190.00	244.00	290.00	18.00	17.00	22.00	18.00	
San Francisco	96.00	108.00	144.00	.....	.....	.....	19.00	.....	24.00	23.00	
Seattle	115.00	125.00	230.00	.....	.....	.....	20.00*f*	21.00*f*	20.00*s*	20.00*s*	

† F.o.b. *a* Smooth. *b* Carload lots delivered to job. *c* 6x12x12 in. *d* Not load bearing. *e* 48 lb. tile. *f* Less $1.00, ½ cash 15 days, balance 30 days. *g* Selected common. *h* F.o.b. Perth Amboy, N. J. *i* F.o.b. Warehouse only. *j* LCL. *k* $1.00 discount if paid in 10 days. *l* Lump. *m* Per bbl., 180 l. *n* Per sack 100 lb. *o* Per bbl., 200 lb. *p* 280 lb. bag. *r* 5% discount 10 da. *s* 2% discount for cash. *t* 5½x8x12. *u* 8% sales tax included.

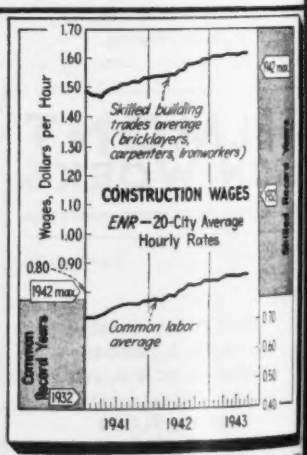
PAINT, ROOFING—F.O.B. CARLOAD LOTS

	RED LEAD Per 100 lb. in 600-lb. (Approx.) bbl. Dry *a*	WHITE LEAD Per 100 lb. in oil	READY-MIXED PAINT Per gal., drums Graphite *b*	Aluminum *b*	Ferric Oxide *d*	ROOFING SUPPLIES Carload lots f.o.b. factory Rolls, slate surfaced, 85–90 lb. per sq.	Asphalt felt, per 100 lb.	Tar felt, per 100 lb.	Asphalt coating per gal.	Tar pitch 350 lb. bbl. per ton
Atlanta	$10.25	$14.125	$1.30	$2.25	$1.20	$1.90	$1.61	$1.61	$0.27	$29.00
Baltimore	10.00	13.75	2.00	3.00	2.50	2.30	2.70	2.70	.40	29.00
Birmingham	10.25	14.125	2.35	3.50*r*	1.98*r*	2.04	1.97	1.97	.32	28.35
Boston	10.00	13.75	1.60	....	2.40	2.12‡	1.72*h*‡	1.72*h*‡	.50‡	21.00‡
Chicago	10.00	13.75	....	....	....	1.75*k*/	1.74*h*/	1.82*h*/	.33/	23.00/
Cincinnati	10.00	13.75	1.70	2.90	1.60	2.40	2.39*h*	2.39*h*	.36	21.00
Cleveland	10.00	13.75	2.10	2.90	1.95	1.93	1.83*h*	1.83*h*	.35	29.00
Dallas	10.00	14.50	1.88	2.11*n*	.05*l*	1.75*h*	1.66*h*	1.66*h*	.35	39.00
Denver	10.50	14.25	1.65	14 25*k*	.27*l*	2.45	3.15	3.15	.36	28.00
Detroit	10.00	13.75	1.75	3.00	1.60	2.10	2.16	2.16	.30	23.00
Kansas City	10.00	13.875	2.39*g*	2.55*gr*	2.16*g*	2.10	2.30	2.30	.28	27.50
Los Angeles	10.25	14.25	1.60	2.25	2.30	2.10	1.50	....	.45	.....
Minneapolis	10.00	13.875	....	....	....	1.75*i*	1.66*h*‡	1.66*h*‡	.32	23.00
Montreal	9.25	6.25	2.50*p*	4.90*p*	3.15*p*	2.67	2 47	2.07	.94	1.85*s*
New York	10.00	13.75	2.03	....*r*	1.64	1.66	1.58*h*	1.58*h*	.26	25.00
Philadelphia	10.00	13.75	1.60/1.80	2.20*r*	1.55	1.75	1.66	1.66	.32	23.00
Pittsburgh	10.00	13.75	1.05	1.95	.80	1.95	1.94*h*	1.94*h*	.34	26.00
St. Louis	10.00	13.75	2.28*s*	2.89*s*	1.96*s*	1.66	1.66	1.66	.29	22.00
San Francisco	10.25	14.00	1.80	2.75*n*	1.35	1.71	2.40	2.40	.33	19.00
Seattle	10.25	14.25	1.90	3.00	....	2.15	2.16*h*	....	.35	26.00

‡ Delivered. Note: Red lead in oil 50c. higher than white lead in oil. *a* Red lead prices change frequently due to pig lead price charges. *b* U. S. War Dept. Spec. 3-49A. *c* ASTM Spec. D266-31. *d* 80% minimum ferric oxide. *e* Subject to 25% discount. *f* Distributors' price to contractors. *g* 5 gal. can. *h* Per roll, 65 lb. *i* Minneapolis and vicinity. *j* Asphalt pitch. *k* Per 100 l. *l* Per lb. *m* Per bbl. *n* May 1941 price, no later quotation available. *p* Plus 8% sales tax. *r* Not available, except on priority rating; then quoted specially. *s* December price.

SKILLED AND COMMON WAGE RATES—PER HOUR

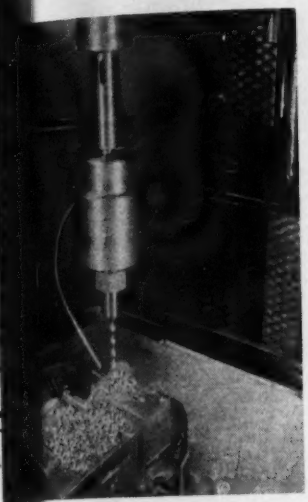
	Bricklayers	Carpenters	Struct. Iron Workers	Hoisting Engineers	Plasterers	Common Labor Building	Common Labor Heavy Const.
Atlanta	$1.50	$1.25	$1.50	$1.25	$1.50	$0.40	$0.50
Baltimore	1.75	1.375	1.80	1.625/1.80	1.50	.75	.75
Birmingham	1.75	1.25	1.50	1.25/1.50	1.50	.65	.65
Boston	1.625	1.50	1.65	1.875	1.667	.80/1.00	.80/1.00
Chicago	1.75	1.70	1.76	1.75	1.825	1.10	1.10
Cincinnati	1.75	1.50	1.675	1.45/1.60	1.625	.85	.85
Cleveland	1.875	1.55	1.75	1.75	1.75	1.00/1.25	1.00/1.25
Dallas	1.625	1.25	1.50	1.75	1.625	.60	.75/1.25
Denver	1.65*b*	1.50*b*	1.625*b*	1.43*b*	1.51*b*	.80*b*	.80*b*
Detroit	1.675	1.50	1.75	1.625/1.75	1.675	.90	.90
Kansas City	1.65	1.50	1.625	1.625	1.65	.90	.90
Los Angeles	1.50	1.35	1.625	1.375	1.667	.875	.875
Minneapolis	1.50	1.375	1.50	1.40	1.50*e*	.925	.925
New Orleans	1.50	1.25	1.50	1.50	1.375	.65	.75
New York	2.00*b*	1.85*b*	2.00	2.00*b*	2.00*b*	1.031	.95
Philadelphia	1.90	1.50	1.90	2.00	2.00	.825	.825
Pittsburgh	1.90	1.75	1.75	1.8125	1.875	.90	.80
St. Louis	1.75	1.50	1.75	2.00	1.75	.95	.95
San Francisco	1.875	1.50	1.75	1.50/1.75	1.75	.95	.95
Seattle	1.78	1 48	1.65	2.00	1.78	1.08	1.10
Montreal	.92	.81	.90	.76	.90	.46	.53



ENR Skilled Average; (Bricklayers, Carpenters, Ironworkers) $1.62
ENR Common Average; $0.869

b 7 hr. day. *c* 30 hr. wk.

...tside diameter, has wall thick-...om .030 to .062 in. Joined with ...er standard tube couplings, the ...ithstood a pressure of 1,500 lb. ...out rupturing or leaking, and ...ue test it was flexed through an ...15 deg. 1,750 times per minute, ...,000 cycles, without failure.—*...mical Co., 1014 Jefferson Ave., ... Mich.*



...terchangeable Driller

... in time and material, fewer in-...d increased production are said ... from use of a new device, the ...rweit Driller, which is inter-...le with the conventional chuck. ...orted that holes as deep as 20 ... drill diameter are drilled by un-...erators or with automatic feeds, ...moving the drill from the holes. ...ller produces small, uniform ...ich clear the drill flutes easily. ... wash away with surplus cool-...bricant, which also bathes both ...he cutting edges of the drill at ...olution.—*The Bastian-Blessing ... Peterson Ave., Chicago 30, Ill.*

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...brought to the work, a recently ... circular division tester is ...be well adapted to check spac-... variety of mechanisms, large ... The instrument comprises two ...laster circle and a microscope. ... is attached to the part to be ...nd carefully centered by means ...e radial adjusting screws in ...n with a precise dial indicator ...st a secial groove around the ... of the circle. The circle mount ... of 2-in. diameter, which may ...d to 1 in., according to the size ...er used. The microscope unit ... a base and upright. Rack-and-...tions are used for the mount-

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ing, to facilitate setting and focusing in relation to the circle. It has a reading micrometer of novel design, by which each complete reading is obtained within the eyepiece.

Ample and uniform illumination of the circle divisions is provided by a special clip-on fixture, and a table of divisions, giving angular spacing of all parts from 2 to 200, is supplied.—*Engis Equipment Co., 310 South Michigan Ave., Chicago, Ill.*

Circular Cutting Tool

To speed up timber connector construction, an improved circular cutting tool has been produced. In preparing the timber for ring-connector joints, the tool cuts circular grooves concentric with the bolt holes in the rabbetted overlapping ends of the timbers to be joined. The depth of the grooves is about half the width of the rings.

This circular groove cutter is made with either two or four removable blades, for split rings from 2½ to 6 in. in diameter. It may be driven by a portable electric drill or drill press, or may be used in a hand-operated brace and bit. A different type of cutting head, with inside blades, is furnished to countersink bearing plates of the same diameter as the connector rings.—*Circo Tool Co., 264 East Ogden Ave., Milwaukee 2, Wis.*

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Efficient lift-truck operation under adverse winter conditions is said to result from the use of a new snow-plow attachment, to peel back heavy blankets of snow. The plow, of safety blade type, is quickly and securely mounted on standard forks, merely by positioning and tightening a set of two-bolt draw-clamps.

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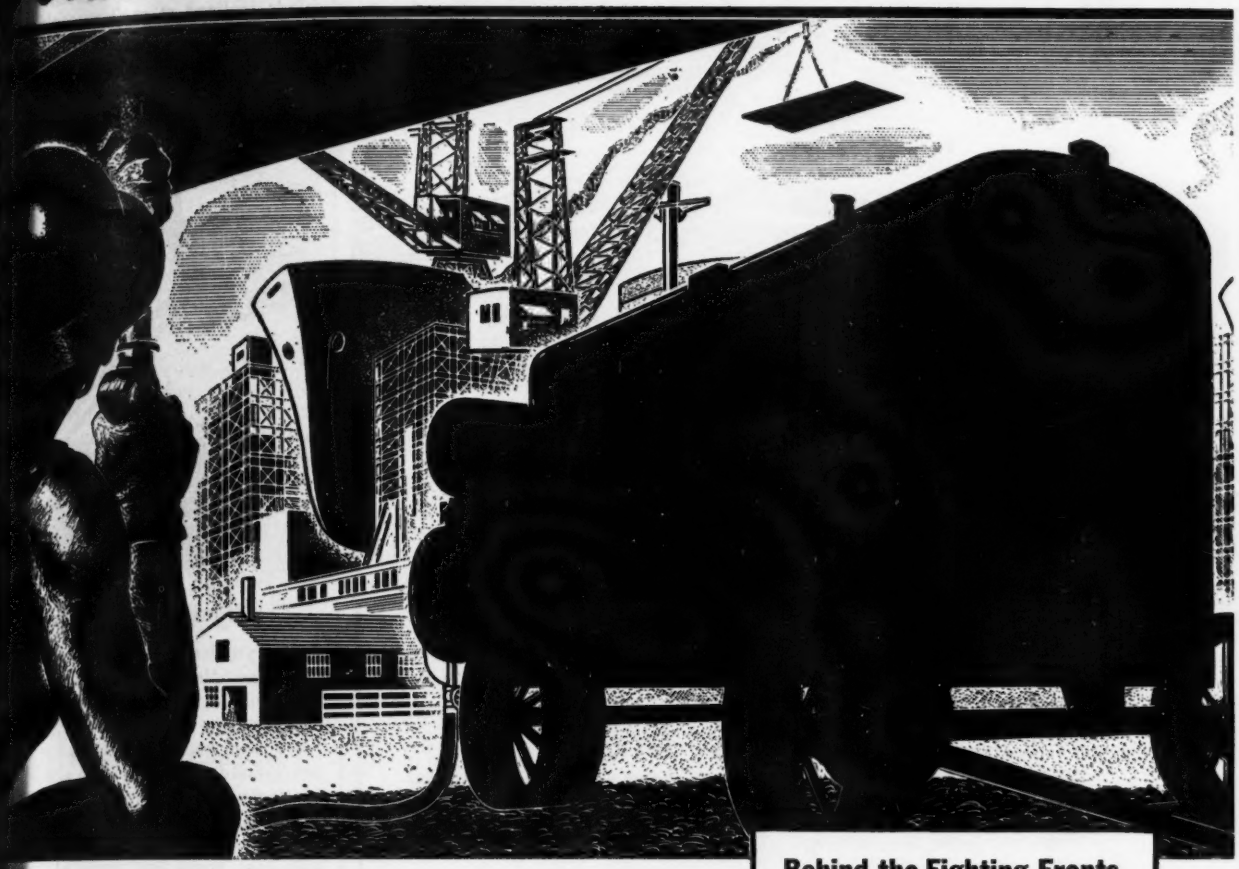

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...the yards where this production ... being made. The chances are, ...d rugged Worthington Blue ...roviding trouble-free round-the-...pressed air. But test for your-... easy-breathing compressors, ...315-foot gas-powered Worthington Blue Brute shown above. Dig into the facts. You'll find this secret in Blue Brutes' performance; Feather Valves* insure simplest "throat" action, no destructive impact.

Results show more air delivered by Worthington Blue Brute compressors . . . portable or semi-portable . . . gasoline, Diesel or electric driven . . . and less air needed with Worthington Rock Drills and Air Tools. Your nearest Blue Brute distributor is listed on page **124.**

* Pat. Off. ‡Blue Brute Compressors and Air Tools are painted olive drab for the Army and ...ay for the Navy until Victory.

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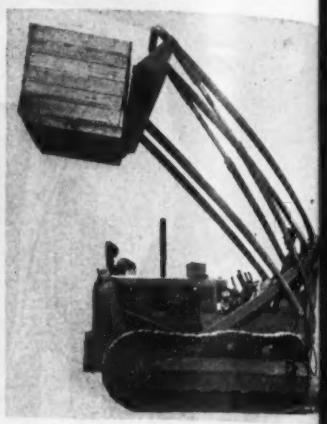
WOLMANIZED LUMBER

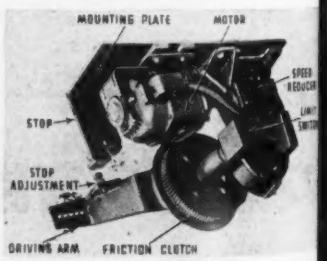
This attachment has a high carbon st blade inclined at such an angle that acts as a safety trip, permitting the pl to ride over ordinary road obstructio It is available in several widths a models.—*Towmotor Corp., 1226 E 152nd St., Cleveland, Ohio.*



Plane Cargo Loader

The problem of loading huge tonnag on cargo planes, under all conditio has brought about the design of a n cargo loader. This loader, mounted on track-type tractor, has good traction o any ground. The tractor can also be us for many other purposes at the airpo

With the load in carrying position, th highest point of the loader is 7 ft., whi will pass under any cargo plane win The operator has a clear, unobstructe view in all directions. Operated by tw hydraulic rams and taking power fro the tractor, the loader will pick up fro ground level and load into a plane wi floor 10 ft. above the ground. A pla form for handling a quantity of packag is available, and can be loaded wi freight for a scheduled flight.—*Pione Engineering Works, 1515 Central Ave Minneapolis 13, Minn.*



Swinging Door Operator

Inward-swinging doors of one- to fo leaf type, and one-leaf outward swingi doors may be easily opened and close by a newly developed swinging-door op erator. One of the greatest advantages o this motor, it is stated, is that when door is stalled or obstructed the clut will slip only until the drive sha

uches the end of its normal stroke. As e limit switch stops the motor in the nal manner, the unit is never over- aded longer than is required to com- ete an opening or closing stroke. The motor parts are illustrated above. e disk on the friction clutch is uipped with an adjustable positive p to insure accurate stopping in both en and closed position. Any tendency the motor to coast past these limits is sorbed by the slipping of the clutch. *Barber-Colman Co., Rockford, Ill.*

Paint-Odor Deodorant

A liquid paint deodorant, equally ef- tive for paint, varnish or enamel, ap- ed by brush or spray, is said to elim- te usual odors completely. It is espe- lly valuable for indoor painting by rcoming allergies, and nose, throat d eye irritations, thus allowing normal ivities to continue while premises are g painted. This deodorant does not ect color, drying or durability, and e quart will neutralize 200 gallons of nt. A quart test bottle is offered for on a money-back guarantee basis.— *lley Chemical Co., 125 East 25th reet, New York, N. Y.*

Rust-Preventive Compound

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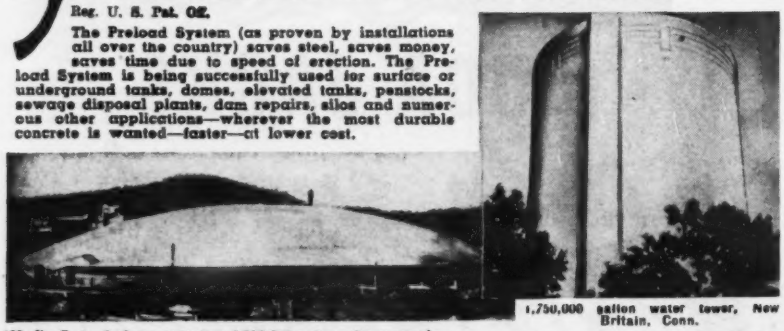

155 ft. Preload dome, covering 1,500,000 gal. water reservoir.

1,750,000 gallon water tower, New Britain, Conn.

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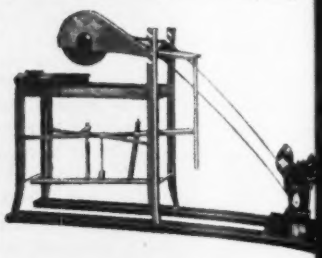
be prevented, the manufacturer claims by application of a new compound "Tectyl 506," which can also be used on machinery or metal stored indoors, subject to frequent handling or abrasion. The compound is a mixture of a solvent and chemicals, which, when the solvent evaporates, deposits a polar film. It may be applied by dipping, spraying or brushing, and may be removed by any common solvent such as gasoline or carbon tetrachloride.—*Valvoline Oil Co., 585 East 5th St., Cincinnati, Ohio.*



Gasoline-Driven Masonry Saw

Powered with a 1½-hp. Briggs-Stratton gasoline engine instead of an electric motor, a new Model "CG" masonry saw is said to be ideally suited to construction projects in outlying districts. This conversion, it is found, has not harmed the flexibility of the saw in any way.—*Clipper Mfg. Co., 4030 Manchester, St. Louis, Mo.*

Electric Metal Heater

Quick and easy in operation is a new soldering transformer, Type T-37. Composed of four legs of silicon steel, the transformer has a primary capacity of 4 kva., and secondary capacity from 2 to .7 kva.; two primary coils in series, one turn secondary; and a voltage range from .3 to .9.

The transformer, 9¾x9¾x8¾ in., not counting the top portion, is said to melt soft solder in 11 seconds, with a load of 9½ amperes on 220-volts. There are five heat speeds, giving ten heat ranges for various grades of work.—*American Chain & Foundry Co., 30 Church St., New York City.*

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90% Open Area
Easy to Install

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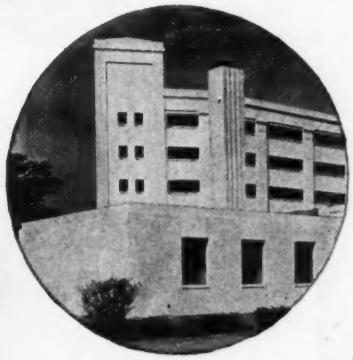
after 10 years' research . . . a scientific contribution to

masonry protection



10 years ago the A. C. Horn Company began scientific research toward finding a more effective preservative treatment for masonry surfaces.

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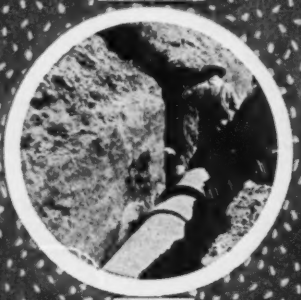

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Cross-Section Underground

If you were to cut a cross-section out of the water and sewer lines running through the nation's communities, you would find many, many more J-M Transite Pipe installations than we have room for here.

In fact you'd find thousands of J-M installations throughout the United States, and hundreds more in our military camps and bases all over the world where the unique advantages of J-M Transite Pipe are providing efficient, economical water transportation. Note these features:

RAPID ASSEMBLY . . . TIGHT, FLEXIBLE JOINTS. Even unskilled crews can form tight joints easily and quickly with the Simplex Coupling. Wide sweeps can be made with straight lengths as the Simplex Coupling stays tight even when the line is deflected as much as 5° at each joint.

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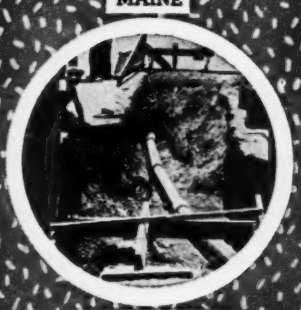

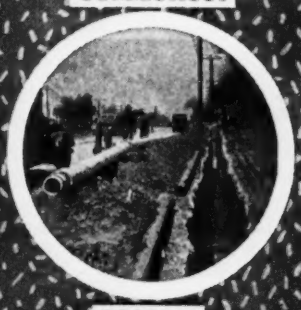

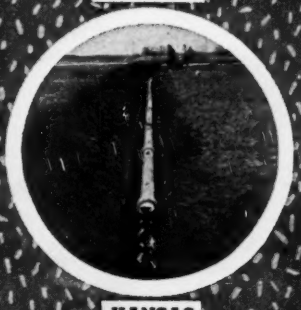

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CUTTING HOLES IN CURVED SURFACES

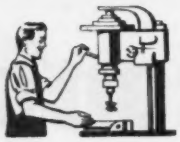
ONE OF THE MANY WAYS THESE NEW-TYPE TOOLS

solve all 5/8" to 10" hole cutting problems!

1.

Cutting *true circles* is no longer a complex problem. The totally different design of Clark Hole Cutters assures quick, smooth cutting in heavy or thin-walled metal or plastic curved surfaces.

2.



Operation is as follows: Blades are adjusted to exact diameter required. Pilot or lead drill acts as guide. Placed in drill press, tool cuts holes accurately, quickly. No reaming or deburring is necessary.

3.

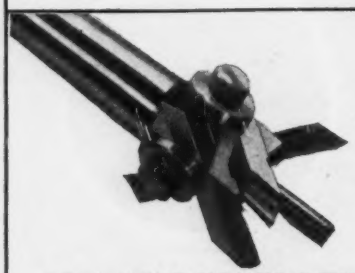
Clark Tools are indispensable for tough, as well as average, production jobs–*curved surfaces, thin materials, overlapping cuts,* others. They're proving essential in many vital industries.

Cut clean holes with

Clark CC

Adjustable

CUTTING TOOLS



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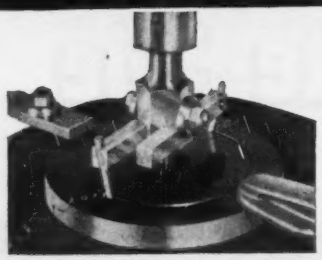
For all curved and flat surfaces. 7 sizes cut any fractional diameter 5/8" to 5", up to 1" thick. Blades easily resharpened by hand or with the CLARK MODEL C GRINDING FIXTURE, built especially for grinding Clark blades at correct angle . . . a low-cost device, assures longer blade life.



ADJUSTABLE FLY CUTTER No. 25

Pitched blades cut clean holes or discs fast, 4" to 10" in diameter, up to 1" thick. MODEL 25G GASKET CUTTER quickly cuts gaskets, rings, discs from live rubber, packings, thin plastics. Has retractable pilot and knife edge blades.

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Models A & B for accuracy, uniformity in grinding National 60° and Acme 29° thread tool bits. Time, material saver.

NEWS OF THE WEEK

(*Continued from p. 75*)

Contracts awarded hasten Central Valley project

The Bureau of Reclamation is borrowing two needle valves from Boulder Dam for the duration of the war in order to complete Friant Dam and Madera Canal which are a part of the Central Valley project in California (*ENR*, July 1, p. 1). Both are 84-inch valves. One will be installed in the Madera Canal outlet of the dam, and the other in the San Joaquin River outlet, to give temporary control over water to be released at the dam. It is expected that control of releases through the dam will be effected by the spring of 1945. Placing the canal in operation is expected to furnish irrigation for approximately 240,000 acres of land.

A contract to build a ten-mile unlined stretch of the irrigation canal has been awarded to Larsen Brothers and Harms Brothers of Sacramento, Calif., on their bid of $48,668. Oberg Brothers, Inglewood, Calif., have been awarded a contract for building a siphon for the canal across Fresno River, on a bid of $135,371. Contracts for the remaining 19 miles are expected to be awarded soon. The 37-mile canal extends northward from Friant Dam to Ash-Barenda Slough.

The War Production Board has disapproved the bureau's request, approved by the War Food Administration, to begin construction of the 160-mile Friant-Kern Canal from Friant Dam southwest toward Bakersfield, Calif., intended to supplement underground water supplies said to be dwindling.

Friant Dam was 90 percent completed when WPB last fall denied priorities for further materials for it and Madera Canal. These projects, given WPB clearance a few weeks ago to proceed with construction, were the first irrigation projects in the bureau's war food program to receive such clearance.

• • •

Engineer Amphibian Command's first anniversary

On the recent first anniversary of the activation of the Engineer Amphibian Command, a unit from Camp Edwards, Mass., "took" Washburn Island, off Cape Cod. This American island was invaded as a preview of invasion tactics in the European theatre of war.

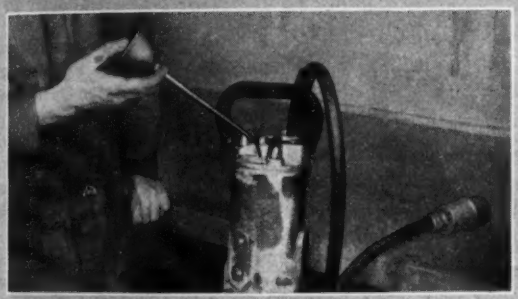
Masking their operations with smoke bombs, the engineers in full battle dress

A Few Minutes' Cleaning

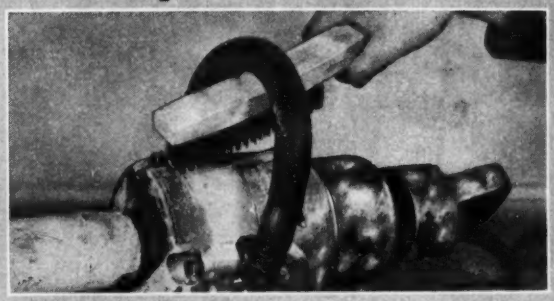
KEEPS MAINTENANCE DOWN

Because each model of CP High Frequency Electric Concrete Vibrators is designed for a specific type of work . . . is ruggedly built . . . well balanced . . . free from reduction gears and flexible shafts, maintenance cost is exceptionally low. But vibrators require reasonable care to keep them at top performance. In addition to lubrication, described in previous advertisements, they should be kept clean. A brisk cleaning at the end of every shift will take but a few minutes — and will pay handsome dividends!

HOW TO GET MAXIMUM SERVICE FROM YOUR CP CONCRETE VIBRATORS



1 A few drops of light oil will cut the mortar out from under the switch and aid cleaning.



2 Clean off switch, motor housing and plug with wire brush at the end of every shift.

3 To insure good electrical contact, inside of plug should be cleaned every day with knife.

4 Clean all concrete off plug every work day using wire brush on outside, knife on inside.

★★★★★★★★★
PNEUMATIC TOOLS
ELECTRIC TOOLS
(Hicycle...Universal)
ROCK DRILLS

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To tell whether the job can be done easier, better or cheaper . . . whether the total output of work will be more with a hydraulic torque converter (Lysholm-Smith type) or a hydraulic power take-off than with a friction clutch demands wide experience with both types of power links. That's why you are sure of unbiased recommendations when you submit your problems to Twin Disc engineers.

Twin Disc engineers have devoted over ten years to the research and development of hydraulics. Units covering a wide variety of applications of hydraulic torque converters and hydraulic power take-offs are now at work. In addition they have had over a quarter of a century's experience in adapting friction clutches to all types of power driven equipment.

This engineering experience and factual data is available now while you are planning new products. Two modern factories—one specializing in friction clutches—one in hydraulics—assure economical production when we return to the manufacture of civilian products. Both of these factors . . . competent engineering and adequate production facilities . . . are important to builders of industrial equipment. TWIN DISC CLUTCH COMPANY, Racine, Wisconsin.

TWIN DISC
CLUTCHES AND HYDRAULIC DRIVES
REG. U.S. PAT. OFF.

hit the beach in seven waves from their own armored landing boats. New tactics exhibited included the use of sappers to probe for mines on the beach, and particularly the use of bulldozers and steel wire mats to lay temporary roads across the soft sand for heavy trucks, tanks and cannon.

The founder and first commanding officer of the unit was the only conspicuous absentee in the gallery of Army and Navy representatives of the United Nations. Brig. Gen. Daniel Noce, who activated the command, is now on the General Staff in the European theater as an adviser on invasion tactics.

Saluting the troops taking part in the invasion, Brig. Gen. David McCoach, Jr., Assistant Chief of Engineers, summarized: "There is little doubt that the work done here at Camp Edwards and elsewhere by the Engineer Amphibian Command has already played an important role in our offensive operations and will continue to be an important factor in our campaigns."

• • •

New York City parkways to be landscaped

Bids have been accepted for landscaping immediately two new express highway links in the Brooklyn-Queens system, New York City, at a cost of $224,554, it has been announced by the Department of Parks.

The first job will include gardening the margins of two miles of Francis Lewis Boulevard between Hillside Avenue and Horace Harding Boulevard in the Borough of Queens. This new road runs eleven miles from the Queens end of the Bronx-Whitestone Bridge southeast to the Belt Parkway along Jamaica Bay. Most of the strip to be landscaped is within Cunningham Park.

Some of the trees to be set out will be mature specimens six inches through the trunk. Steeper slopes will be saved from erosion by bushes and vines. Other plantings will mass flowers around lawns.

• • •

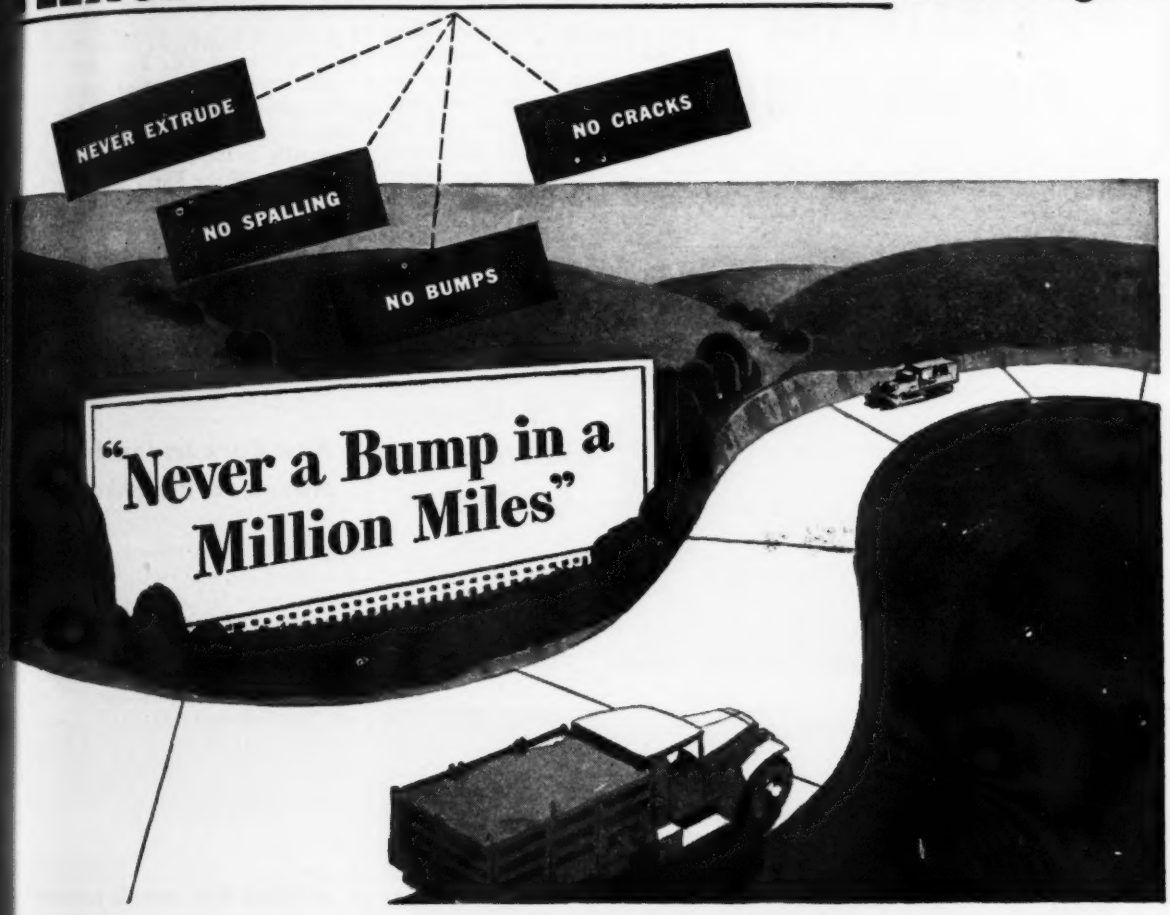
Fort Peck Dam power goes to war industries

The major part of the newly produced power at Fort Peck Dam, Mont., will be distributed by the Bureau of Reclamation to war industries in that state and Utah, Secretary of the Interior Harold L. Ickes has announced on the basis of a report from the bureau's Commissioner, Harry W. Bashore.

The plant, which has begun commercial activity with more than 30,000

Here's why roads built with

FLEXCELL EXPANSION JOINTS last longer!



Flexcell Bituminous Fibre Expansion Joints Provide Lowest Maintenance Cost Per Mile

THE MODERN WAY to insure long life for highways is to use Flexcell, made by Celotex. It is the original bituminous fibre expansion joint. Flexcell Expansion Joint compresses readily *without extruding* under pressure from expanding concrete, and springs back to fill the joint when the concrete contracts. Joints are smooth, weathertight and permanent.

Flexcell is readily used in any of the conventional methods of installing expansion joint. Because first cost of expansion joint is such a small fraction of the total concrete cost, modern highway engineers make it a rule to specify Flexcell. Meets Army, Navy and A.A.S.H.O. specifications. You can get prompt service now! Mail coupon today for full information.

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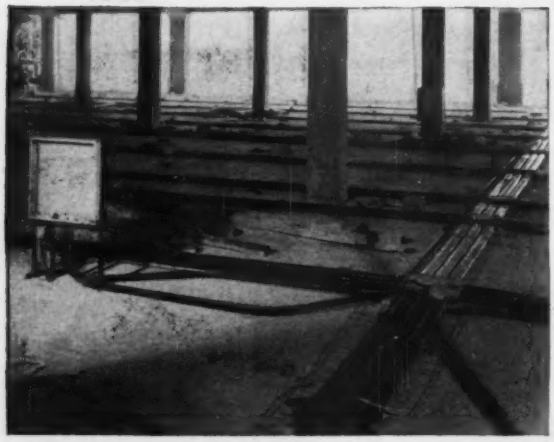
General Electric offers two types of underfloor wiring. Both give almost unbelievable flexibility to shops, factories, offices, etc. Electrical outlets can be added later as they are needed.



G-E Fiberduct installation.

Use G-E FIBERDUCT With Masonry and Wood Type Construction

G-E Q-Floor Wiring installation.

Use G-E Q-FLOOR WIRING With Robertson Q-Floors

Send the coupon for catalogs giving further information on these flexible underfloor wiring systems.

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GENERAL ELECTRIC

kw. of capacity, was constructed and is operated by the Corps of Engineers, but the output is distributed by the Bureau of Reclamation. Rates are subject to approval by the Federal Power Commission.

Acting Commissioner Bashore advised Secretary Ickes that Fort Peck power would have an important place in the development and utilization of the mineral resources of Montana and Utah, especially in the prosecution of the war.

Addition of the power from Fort Peck Dam to the Bureau of Reclamation systems in the West brings to more than 1,875,000 kw. the capacity of 31 plants on reclamation projects or plants the output of which is distributed by the bureau.

• • •

New York Bridge Authority moves to Poughkeepsie

The New York State Bridge Authority is transferring its office from Catskill to Poughkeepsie, Chairman Robert Hoe has announced. He said the move had Governor Thomas E. Dewey's approval, and was intended to make the office more centrally located. The authority operates the Rip Van Winkle bridge at Catskill, the Mid-Hudson bridge at Poughkeepsie, and the Bear Mountain bridge at Peekskill.

• • •

Million kw. mark passed by Bonneville-Coulee

The Bonneville-Grand Coulee power system Aug. 17 passed the million-kilowatt mark in power production for the second straight day, placing the Pacific Northwest's federal power system alongside of Boulder Dam as one of the nation's greatest producers of hydroelectric power.

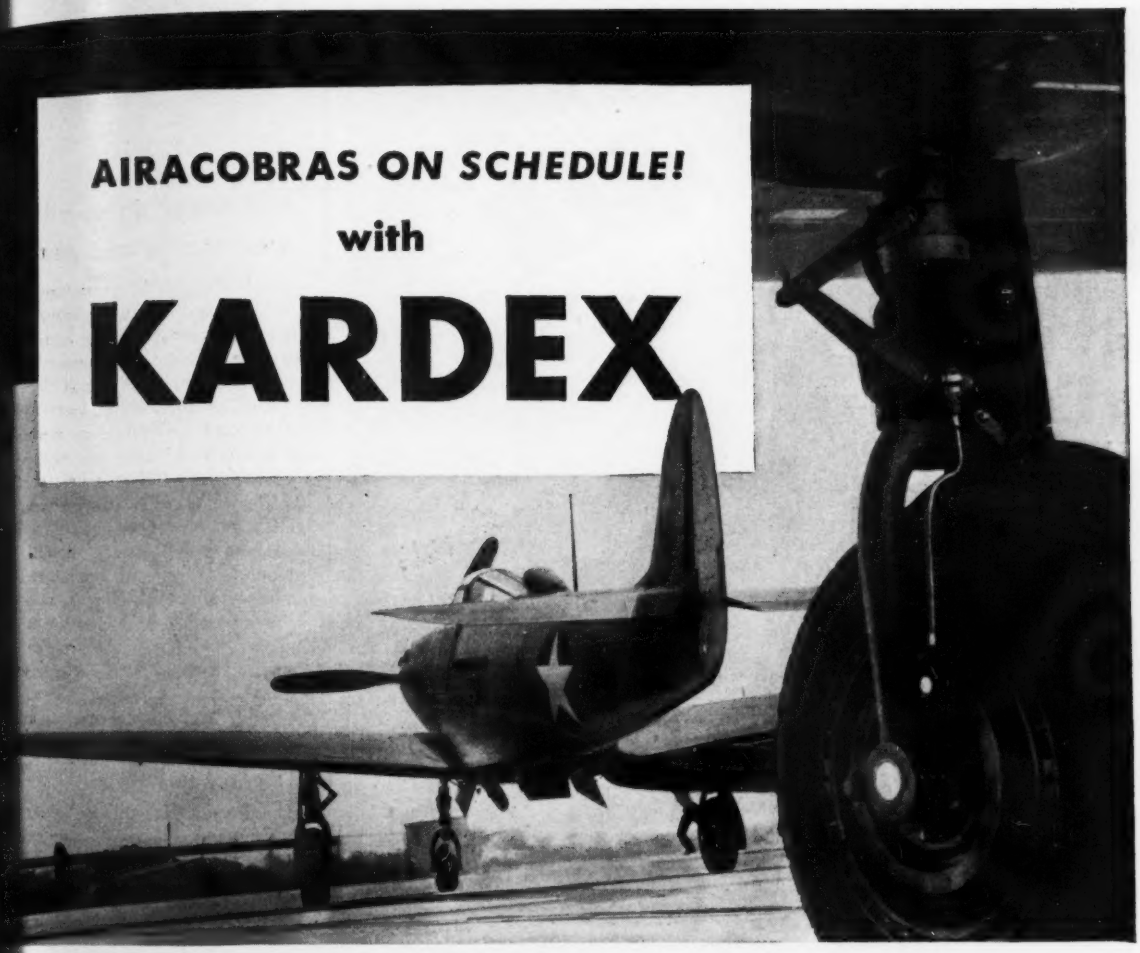
Bonneville Power Administrator Paul J. Raver said operating reports showed a peak demand of 1,024,000 kw. was reached Aug. 16, only to be surpassed the next day by a peak of 1,033,000 kw. This is the first time in the five-year history of the federal transmission network that the two Columbia river dams have delivered more than 1,000,000 kw. a day.

Administrator Raver reported that the heavy demand on the Bonneville-Coulee system at this time was due primarily to the accelerated tempo of northwest industries. By delivering large quantities of power into the Northwest power pool, the government power plants have made it possible for other Northwest utilities to maintain their reservoirs at

AIRACOBRAS ON *SCHEDULE!*

with

KARDEX



The story of Bell Aircraft's rise from a small plant to one of the world's greatest plane-producing outfits in a few years is a tribute to American ingenuity *and system!*

Remington Rand's Kardex ible Production Control Records play an important in speeding up Bell's assembly line operations, while cing delays and error to a minimum.

ardex Control Systems have been fully as success- ironing out the production, construction and engi- ng problems of other industries, too.

A valuable Kardex feature is the *exclusive* Graph-A-Matic "seeing eye" signal which gives you an *instantaneous* picture of where you stand from day to day on materials, production. procurement, personnel.

May we send you a copy of our "Systems Narrator" that tells of Bell's success story? Also available on request is the interesting "Management Controller" MC-649 which shows what Kardex has accomplished for the Engineering Division of a large, well-known manufacturing concern.

Write to us at Buffalo, or phone your nearest Remington Rand office (it's probably listed on the Yellow Pages of your local phone directory).

REMINGTON RAND

BUFFALO 3, NEW YORK

NOVO GENERATOR SET

On planes, tanks and ships it's "Fire Power"—for fast construction it's "Light-Power" that brings your vital jobs through ahead of schedule.

The Novo Generator Sets or "Light Plants" are powered with heavy duty industrial type engines—simple and fool-proof in construction—no extra gadgets, non-automatic, economical in original cost and operation.

Engines are equipped with efficient governors that hold voltage practically constant. All Novo Engines are antifriction bearing equipped and have extra large fuel tanks and large oil capacities for long periods of operation.

Unfailing LIGHT for night work and POWER for small electric tools.
Send for complete information.

FREE INSTALLATION DATA

We have for your use, Installation Data Sheet No. 2002 which gives useful information on the operation and installation of generator sets, how to figure loads and selection of wire, different current characteristics, etc.

FACTORY OVERHAUL OF ENGINE

A factory overhaul for your Novo Engine regardless of the equipment on which it is mounted, Pump, Hoist, Mixer, Light Plant, etc., will make the heart of that equipment practically new and these jobs carry a new equipment guarantee—See your Novo Distributor or write us for full information.

NOVO ENGINE COMPANY,
200 Porter St., Lansing, Michigan

We would like to have complete information on the Novo Light Plants.....
also Free Installation and Performance data.....

Name.....
Address.....
City.....State.....

high levels and to save fuel that would otherwise be needed for steam generated power.

. . .

Highways damaged by war traffic and heat

Quick changes in temperature, excessive heat, and unusually heavy wartime traffic have combined to cause a considerable number of "blow-ups" of concrete pavements and much "bleeding" of bituminous-treated highways throughout Indiana and Ohio, as reported by the two state highway commissions.

More than 10,000 miles of Ohio's 18,500-mile state highway system have been adversely affected by these conditions, reports Harry D. Metcalf, chief engineer, division of maintenance. Bituminous-treated highways soften under excessive heat and the material runs, producing a sticky condition which is an irritation to the traveler, creates a traffic hazard and rapidly deteriorates the road. Traffic picks up this softened material and by so doing cuts deeply into the pavement, said Metcalf, who reported that his department is rapidly remedying these conditions by screening the bleeding surfaces and repairing blowouts in pavements.

In Indiana approximately $2,000 has been added to maintenance costs for repairing pavements damaged by blowups in the last 30 days, reports S. C. Hadden, chairman of the State Highway Commission. Rapid expansion and contraction of pavements under a hot sun and cooling showers results in the pushing up and cracking of pavements, causing a safety hazard for motorists, said Hadden, who also stated that occasionally these humps are from 12 to 14 in. high and must be broken down, the old pavement removed and the new section of pavement laid before the road is ready for normal traffic use.

. . .

Civil service adopted by county in Georgia

Establishment of a civil service agency for county employes recently has been adopted by Fulton county, Ga. With the exception of persons already covered by civil service and employees of the departments of public welfare, health and public works, all county employes are placed in the classified service. Employes of any department in the unclassified service may elect to come into classified service by a majority vote of the employes in the department.

Short circuit on America's busiest assembly line

SHUDDERING JOLT, a careening lurch i
darkness, and a truck laden with vita
hies crashes into the ditch . . .
rtantly, an important link
m—the nation's busiest
like a blown fuse, all
k in the pav
This mes

. . . and all because of road failure!

The Barrett advertisement above, clipped from The Saturday Evening Post, emphasizes the vital importance of maintenance and repair to keep America's war-time highway system in first-class fighting trim.

It points out that despite gasoline rationing, America's roads are actually wearing out faster today than in peacetime. Right now, with truck traffic up more than 40 per cent—with 4,500,000 trucks transporting raw materials and finished goods—this country's highways are doing extra duty day and night.

That is why road officials and engineers are making *maintenance* the keystone of their current programs. Worn roads can cut down production schedules, waste vital man-hours, menace national safety and cause costly damage to automobiles and tires.

Why not discuss your maintenance problems with the Tarvia field man? There's a right type of Tarvia for the repair and maintenance of almost every type of road.

*Trade-mark Reg. U. S. Pat. Off.

THE BARRETT DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 RECTOR STREET, NEW YORK

York · Chicago · Birmingham · St. Louis · Detroit · Philadelphia · Boston · Providence
ester · Minneapolis · Cleveland · Columbus · Toledo · Youngstown
use · Buffalo · Cincinnati · Bethlehem · Portland, Me. · Bangor, Me.
wood, N.Y. · Cromwell, Conn. · Norwich, Conn. · Savannah, Ga. · Norfolk, Va.
anada: THE BARRETT CO., LTD. . Montreal · Toronto · Winnipeg · Vancouver

Barrett Tarvia*

Cracked DIESEL CYLINDER HEADS MADE EQUAL TO NEW

THIS IS WHAT IT TAKES to stop your cylinder head trouble

Repairing of cracks only is not enough. Thorough reconditioning is necessary, so that when the head goes back into use you can be sure of trouble-free service.

You don't gamble when you send your cracked Diesel cylinder heads to STARK.

STARK 10-POINT RECONDITIONING PROCESS

EXAMINATION — All parts removed, head thoroughly examined.

PREPARATION — Old, burned metal around all valve seats removed. Head prepared for uninterrupted welding in pre-heating oven.

PREHEATING — Head preheated in temperature controlled oven of special Stark design. All cracks become visible.

WELDING — Cracks acetylene-welded by specialists working exclusively on heads.

VALVE SEATS — All built-up with hard alloy wear-resisting metal.

TESTING — Hydrostatic test makes sure no cracks are overlooked.

RESURFACING — All surfaces of head ground (not machined) to factory finish.

MACHINING — Built-up valve seats machined with production cutters. All other machining to original specifications.

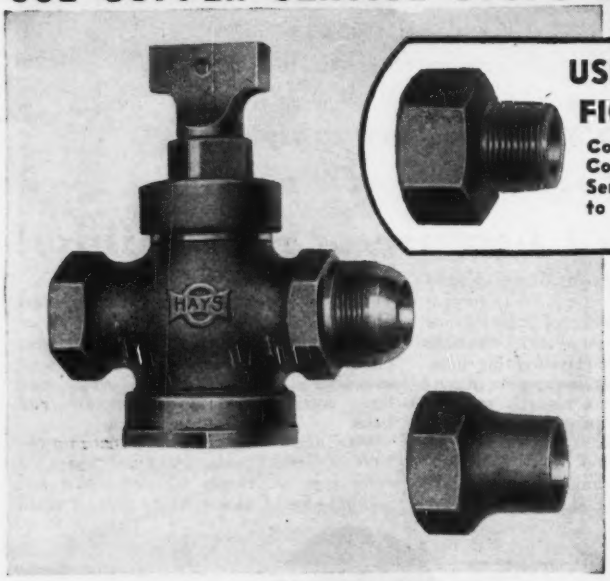
GRINDING — New valve guides installed; seats precision ground for perfect seating.

INSPECTION & ASSEMBLY — All parts replaced; head checked for immediate use.

RALPH STARK INC.. 43-12 Thirty-third St., Long Island City, N. Y.

SPECIALIZED RECONDITIONING

USE COPPER SERVICE STOPS IN STOCK



USE HAYS FIG. 543 R

Convert Copper Service Stops to Iron Pipe—

Make use of copper service stops in stock when copper pipe is not available. If you wish to convert to iron pipe, use Hays No. 543 R Adapters.

HAYS MANUFACTURING CO • ERIE • PA.

WATER WORKS PRODUCTS

HAYS (SINCE 1869)

★ Invest in Bonds today to provide for extensions tomorrow ★ ★ ★

BRIEF NEWS

War houses in Portland, Ore., now total 13,856, of which 12,666 or all but 1,190 are occupied, the Oregon Housing Authority has revealed. The authority has a total of 18,552 completed, under construction or projected. Of the 9,94[illegible] planned for Vanport, 8,048 are completed and 7,051 are occupied.

A plan for the repairing of streets in almost all the towns and cities in Puerto Rico has been submitted to the Washington authorities to be undertaken with funds from the $7,000,000 appropriation recently approved by Congress, and contributions required from the Puerto Rican government.

The Kentucky State Treasury has transferred $743,207 from the Treasury surpluses of two fiscal years for construction, repairs, rehabilitation, equipment and land acquisitions at state institutions. According to Finance Commissioner, W. Arch Bennett, this amount brings to $2,531,302 the total approved for allotment from the fund. Of this sum, $1,994,302 will be used for general rehabilitation, construction and land acquisition; $535,000 for Welfare Department equipment and $2,000 for a campus addition at Kentucky College for Negroes at Frankfort.

Following what is said to be the most disastrous storm in that region in half a century—a record rainfall of 6.81 in. in seven hours—Steubenville, Ohio, a few weeks ago, suffered property damage estimated at $500,000. The city's water supply was wrecked, it was reported, when debris of five houses was hurled over state route 7 on to waterworks property, gouging a 20-in. main out of the ground and disrupting pumping service to the filtration plant and reservoirs. City crews and engineers employed by industrial concerns worked to repair the water mains.

President Roosevelt has placed the completion, maintenance and operation of Denison Dam at Red River in Texas under the War Department, and has designated Secretary Ickes agent for the sale and distribution of power generated there. By the same order, effective Sept. 1, the president transferred to Secretary Ickes from the Federal Works Administrator authority over the Grand River Dam Authority, Vinita, Okla., and the Norfolk project of the North Fork of the White River in Arkansas and Missouri.

HERE'S JUST THE AIR COMPRESSOR

To See the Job Finished

You're assured of continuous operation—from the time a job is started until it is finished—when you use a Schramm Compressor.

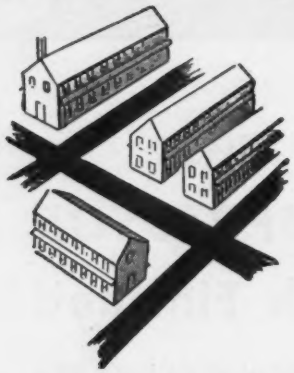
At work, in this illustration of a New York office building, is the Schramm #315 furnishing air for numerous riveting gangs at maximum pressure. Uniform water cooling permits operation of the compressor with housing doors in place, a protection against dust clogging vital parts.

Long-life Schramm features include push button starter, mechanical intake valve, and discharge valve permitting less wear per air foot delivered. Each Schramm Compressor is compact, lightweight, and employs full force feed lubrication to every moving part... For complete details write today for Catalog 42-PA.

SCHRAMM INC.

THE COMPRESSOR PEOPLE • WEST CHESTER, PENNSYLVANIA

ASPHALT
for
CANTONMENT STREETS



Various low-cost types of Asphalt construction are ideally suited for cantonment streets where an improved all-weather surface is needed. Asphalt can be easily maintained for as long as it is needed, and can be abandoned at any time without a great investment loss.

Wherever Standard Oil Asphalt products are sold, there is an Asphalt Representative who can give you full information about these and other uses of Asphalt. Write

STANDARD OIL COMPANY (Indiana)
910 SOUTH MICHIGAN AVENUE, CHICAGO

. . . are the choice of those who want JACKSON standards of quality, dependability and performance. No other flexible shaft vibrator can offer such assurance.

Supplied with a 2⅜" and a 1¾" head. These two heads give user a vibrator efficient in and suitable for a wide range of applications. For instance, from wall sections of comparatively large size to narrow sections.

Model FS-6A, illustrated above, is furnished complete with 7, 14, 21 or 28 feet of shaft. Has dirt-proof turntable base. Supplied with or without wheelbarrow mounting.

Write, wire or telephone for further information

ELECTRIC TAMPER & EQUIPMENT CO.
LUDINGTON, MICHIGAN

MANUFACTURERS' ACTIVITIES

R. J. NADHERNY has been made production manager of Athey Truss Wheel Co., Chicago, Ill. Mr. Nadherny has had 20 years experience with equipment similar to the products manufactured by Athey. Seven years of this time were spent in sales engineering capacities with the Mercury Mfg. Co., Chicago.

REAR ADMIRAL ALEX M. CHARLTON, U. S. Navy inspector of Navy material, Chicago, Ill., was present at the awarding of the third Navy "E" emblem to the Union Wire Rope Corp., Kansas City, Mo., recently. Richard Kauzlaurich, machine operator in the plant, topped the winners in 14 other departments with a work record of 10 hours and 48 minutes nightly since the first of the year, and to him went the honor of raising the Navy "E" flag. In praising the plant's production, Rear Admiral Charlton said the wire rope it had made for the Navy in recent months would stretch from the plant in Kansas City to Guadalcanal and extend on to Australia.

SIDNEY L. MYERS, export and federal sales manager, LaPlant-Choate Mfg. Co., of Cedar Rapids, Ia., manufacturers of dirt moving and road building equipment, has been appointed a member of the Allied Tractor Equipment Industry Advisory Committee of the War Production Board. This committee is composed of representatives of companies in the tractor equipment industry and allied branches. Mr. Myers has been identified with LaPlant-Choate for 20 years.

L. S. WOOD, vice president in charge of engineering of the Gar Wood Industries, Inc., Detroit, Mich., has announced the appointment of George D. Shaeffer as chief engineer of the engineering department. A. C. Evans was promoted to chief engineer of the road machinery division.

Eight Ships

TO SAIL THE SEVEN SEAS

00 tons of ferrous metal—enough for a small ada of eight 10,000-ton Victory ships—that is ontribution of Lock Joint Reinforced Concrete sure Pipe to the war effort.

his conservation of iron and steel in the produc- of vitally needed projects was accomplished out lessening in any way the high quality or ormance of these pipelines.

Concrete pipe, ideally used in peace-time for the construction of water supply, mains, sewers and culverts, is even more suitable in war-time with its all-out conservation of time, labor and material.

• • • •

Whether your project is large or small, your 'phone call, telegram, cable or letter to any of our offices will bring a prompt reply.

OCK JOINT PIPE COMPANY

Established 1905

AMPERE, NEW JERSEY

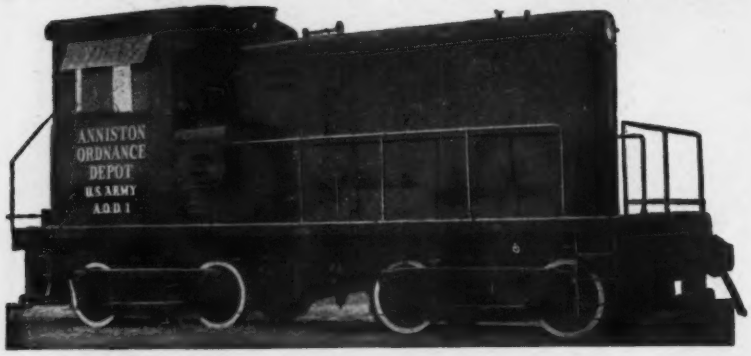
, Colo. · Chicago, Ill. · Kenilworth, N. J. · Kansas City, Mo. · Rock Island, Ill.
Plains, N. Y. · Valley Park, Mo. · Cleveland, Ohio · Hartford, Conn. · Navarre, Ohio

OPE OF RVICES

Lock Joint Pipe Company specializes in the manufacture and installation of Reinforced Concrete Pressure Pipe for Water Supply Mains as well as Concrete Pipe of all types for Sanitary Sewers, Storm Drains, Culverts and Subaqueous lines.

LOCK JOINT
Reinforced Concrete
PRESSURE PIPE

ONE EYE on the FUTURE



DAVENPORT LOCOMOTIVES

Most business men are doing a lot of solid thinking against the day when hostilities cease. Nor are they neglecting for an instant the grave responsibilities of war. They drive themselves in support of increased production. They are positive, dependable units in the unbeatable aggregate we call Democracy. The time they give to post war planning simply adds to the fervor of their war service because it makes them see more vividly the stakes for which we are fighting. No wonder many are giving thought NOW to the superb performance of Better-Built Davenports on those bigger haulage operations that merely await the passing of a little more time—until VICTORY.

STEAM-GASOLINE-DIESEL
LOCOMOTIVES
ELECTRIC OR
MECHANICAL DRIVE

EXPORT FORCES **BROWN & SITES** 50 Church St., N. Y. Cable Add." Brosites"

DAVENPORT LOCOMOTIVE WORKS

A DIVISION OF DAVENPORT BESLER CORPORATION, DAVENPORT, IOWA

PLYWOOD INVASION BARGES
MADE FOR UNITED NATIONS!

● Add invasion barges to the long list of war jobs Douglas Fir Plywood is doing. This sturdy, lightweight engineered lumber is being used for transportation equipment of all kinds, for military and war worker housing, for factory construction and scores of other purposes. Because of this wide and varied experience, you're sure to find Douglas Fir Plywood one of your most useful post-war construction materials.

FREE FOLDER SHOWS OTHER PLYWOOD WAR USES
Write for your copy today. Douglas Fir Plywood Association, Tacoma Bldg., Tacoma, Washington.

DOUGLAS FIR PLYWOOD
Real Lumber
MADE LARGER, LIGHTER
SPLIT-PROOF
STRONGER

STRONGER PER POUND THAN STEEL!

I. C. Moreau was assigned the duties of chief engineer of the hoist and body division. J. E. Monahan was placed in charge of all hydraulic engineering. The four engineers who were promoted have been in the employ of Gar Wood Industries, Inc., for many years and have a noteworthy record of engineering achievement.

THE CONTINENTAL RUBBER WORKS of Erie, Pa., is celebrating its fortieth anniversary this year under the same management which organized the company in August, 1903. Then, as now, the President of the company is T. R. Palmer. Three of the original directors are still board members and three more of the present board are sons of the original directors or officers.

While the Continental plant has been materially expanded at several periods in the growth of the company, the factory and home office are still located at the original address. The original floor space of 45,000 square feet has been repeatedly enlarged until the Continental factory now contains more than 300,000 square feet. The initial capitalization of $150,000 has grown to $3,000,000.

Continental was one of the first rubber goods manufacturers to work with synthetics. This development started several years before the war and expanded rapidly as natural rubber became progressively scarcer.

In addition to the factory at Erie, Continental maintains twenty branch offices and thirteen warehouses in leading cities.

C. T. RUHF has been elected president of Mack Trucks, Inc. He has been with Mack since 1912, and had been executive vice president since last January. Prior to that time he had been operating vice president in charge of factories.

In 1920 Mr. Ruhf was appointed assistant to the factory manager of the Allentown plant, in which position he served until appointed factory manager in 1937. In 1938 he was made operating vice president in charge of production at the company's plants in Allentown, Pa., Plainfield, N. J., and New Brunswick, N. J.

MATTHEW R. ROSSE has been appointed sales manager of the export division of the Wickwire Spencer Steel Co. Mr. Rosse was born in Glasgow, Scotland, but was brought up and educated in the United States. He has had more than 25 years continuous experience in the exporting of steel products.

TODAY
S ALWAYS

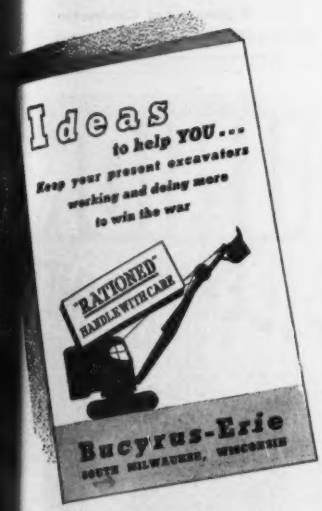
FOR EFFICIENT DIGGING

MOVE MATERIAL THE SHORTEST DISTANCE IN THE SHORTEST TIME

Are you sure you are getting the most out of your excavating equipment? That your job setup takes full advantage of the primary factors of Distance and Time to secure efficiency and long life?

Under pressure of continuous 3-shift wartime operation, on-the-job compromises may bring about alterations in your planned setup which result in lowered production. To overcome this, owners and operators will find it advantageous to make occasional checkups of their machines and methods.

As a guide to such a fresh and critical approach, we have prepared a booklet filled with down-to-earth suggestions. Ideas for the operator, tips on maintenance and the importance of adjustments, brass-tack discussion on lubrication, power plant servicing, hints on efficient handling of shovel, crane and dragline and on the importance of observing safety rules — all are presented in simple, readable form which we believe every owner and operator will find useful. A copy is yours for the asking from your Bucyrus-Erie distributor; or if you prefer, write us direct.


Ideas
to help YOU...
Keep your present excavators working and doing more to win the war
"RATIONED" HANDLE WITH CARE
Bucyrus-Erie
SOUTH MILWAUKEE, WISCONSIN

This 32 page, 5½ x 8½" booklet, attractively illustrated and printed in two colors, is packed with practical, experience-tested suggestions on how to maintain maximum excavator production. The material applies to any make of excavator, any size. Extra copies available for your operators and foremen.

KEEP EVERY EXCAVATOR PRODUCING AT MAXIMUM EFFICIENCY

ARMY E NAVY

Bucyrus-Erie

SOUTH MILWAUKEE, WISCONSIN, U. S. A.

END 50° SLOW-UP* in Fall Concrete with

SOLVAY Calcium Chloride

★ Chilling Fall temperatures, from 50° to 32° seriously affect both the development of strength and the ultimate quality of concrete. SOLVAY Calcium Chloride serves largely, if not entirely, to offset the slowing-up effects of temperature drops and provides extra cold weather protection.

Use SOLVAY Calcium Chloride to increase early and final strength of concrete. It will not change the normal chemical action of Portland cement. It is low in cost.

Send for complete information. Write to Dept. 37-9.

SOLVAY SALES CORPORATION
40 Rector Street New York 6, N. Y.

and industrial equipment. Mr. Rosse will be located in the company's general offices at 500 Fifth Ave., New York, N. Y.

A. E. MacInnis was recently placed in charge of national sales of the Henry Mill & Timber Co., Timber Fabrication Division, Tacoma, Wash. MacInnis was head of the post-war planning and research department of a large Pacific Northwest marketing organization where his work revealed the possibilities of engineered timber structures in post-war reconstruction. He resigned that position to join the Henry Mill. MacInnis was formerly vice president of the Petroleum Heat & Power Co.

Don D. Foster has been appointed assistant sales manager of the Pittsburgh Equitable Meter Co. Mr. Foster was formerly district manager for the Pittsburgh territory. In his new capacity he will be acting head of the sales divisions for both the parent concern and subsidiary, the Merco Nordstrom Valve Co. Mr. Foster is a native of Pittsburgh and a graduate of Carnegie Institute of Technology.

S. R. Kallenbaugh has been appointed West Coast district manager of the steel and tube division, Timken Roller Bearing Co., Canton, Ohio, whose Western offices are at 1526 South Olive St., Los Angeles, Calif. Kallenbaugh is a graduate of Mt. Union College and has had post-graduate training in metallurgy at Ohio State University.

Cochrane Corp., Philadelphia, Pa., has announced the recent appointment of Roy L. Stone as flow meter representative with offices in the Commerce Building, Rochester, N. Y., and 295 Hartford Ave., Kenmore, Buffalo, N. Y. This organization also handles Hays combustion controls and Reliance gage columns, thus offering complete instrumentation service. Cochrane heaters, softeners, filters, blow-down systems, multiport relief valves, separators and drainage equipment con-

Steel Pipe Line encased with GUNITE

Actual photograph showing a 2 inch covering of GUNITE (Pressure Concrete) applied pneumatically to a 48 inch steel pipe line.

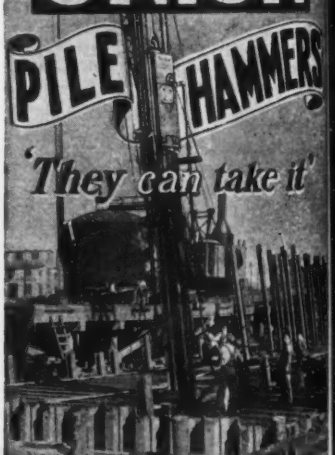
This is one of our recent jobs showing the adaptability of reinforced GUNITE on this type of work.

- GUNITE adheres perfectly to steel surfaces.
- GUNITE preserves the pipe by resisting moisture and eliminating the possibility of corrosion.
- GUNITE is unequalled for repair and maintenance work.

Write for illustrated Bulletin of GUNITE construction. Let us estimate on your work.

Pressure Concrete Co.
GUNITE
Engineers and Constructors
6 Avenue B, Newark, N. J.

UNION



Ready! —for quick reference and ALL FACTS on what UNION makes for speedy plant construction — write or wire NOW for Catalog 1943

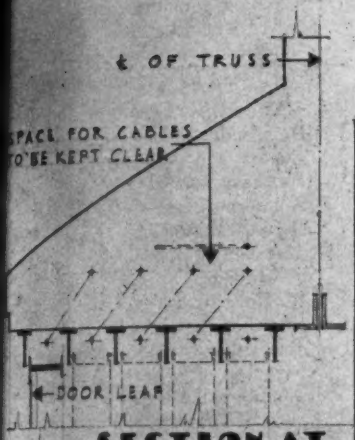
EST. 1900 **Union Iron Works, Inc.**
ELIZABETH, New Jersey

BYRNE HANGAR DOOR TYPES

PART OF A COMPLETE SERIES FOR EVERY TYPE HANGAR

No. 3 BYRNE MOTORIZED SLIDE DOOR

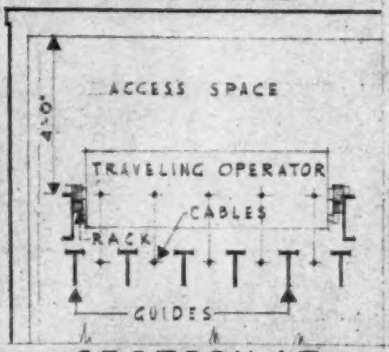
·FOR OPENINGS OF ANY WIDTH AND HEIGHT · MULTI-LEAF MOTOR OPERATION



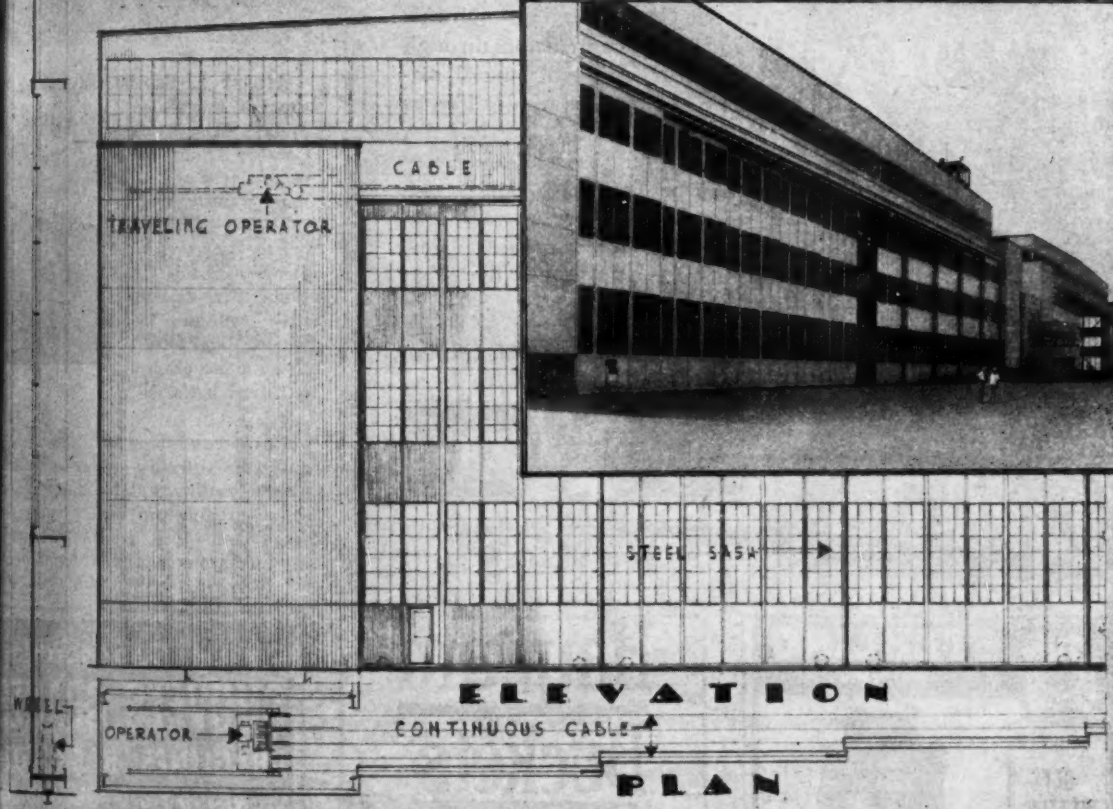
SECTION AT DOOR OPENING

BYRNE Motorized Slide Doors are operated by the Byrne Multi-leaf Operator, which provides positive traction and differential speed for each door leaf. The leaves arrive simultaneously at open or closed position. The operating cable may be easily disconnected for manual operation.

BYRNE Motorized Slide Doors save man-power and heat and give swift, reliable service under all conditions.



SECTION AT DOOR POCKET



ELEVATION

PLAN

BRANCHES:
WASHINGTON, D.C.
SAN FRANCISCO
NEW YORK

BYRNE doors
incorporated
1150 Griswold Street • Detroit, Michigan
Cable Address: BYRNDOR

Consult Byrne without obligation. For further details and other types of doors, see the Byrne catalog in Sweet's

Consult

EARLE

on

BRIDGE OPERATING MACHINERY PROBLEMS

Earle Gear is serving engineers and bridge constructors through the manufacture of special machinery for operating all types of bridges — swing, vertical lift, rolling lift, bascule and ferry transfer. Earle also builds special machinery to operate sewage disposal plants, locks, dams, gates, dredges, etc. Request Bulletin 42-B.

THE EARLE GEAR & MACHINE CO.
4717 Stenton Avenue, Philadelphia 44, Pa.

EARLE GEARS

tinue to be handled by David R. Mur... 611 Hazelwood Terrace, Rochester, N...

W. S. SEWART has been appointed ... sistant sales manager of the Hardw... Products Division of the Wickwire Sp... cer Steel Co. and its subsidiary, ... American Wire Fabrics Corp. Mr. Sew... has been with the company since 19... He will be located at the home offi... 500 Fifth Ave., New York, N. Y.

THE H. K. FERGUSON CO., Clevela... Ohio, industrial engineers and builders, have opened a Southern district office at Birmingham, Ala. The office will be managed by C. W. Roberts, a Texan who has been associated with the Ferguson organization since the early '30s. His most recent assignment was ... project manager at the Rocky Mounta... Arsenal, Denver, Colo., where the co... pany was awarded the Army-Navy "E" ... for excellence in construction.

ALBERT S. FROMM, advertising ma... ager of the Union Metal Mfg. Co., Canton, Ohio, became mayor of Canton on August 2, following the death of the former incumbent, Ed S. Folk. Mr. Fromm will continue as Union Metal advertising manager on a part-time basis.

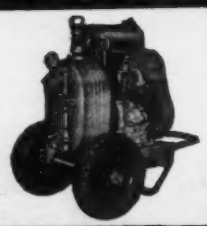
PLANS FOR A RESEARCH, development ... and administrative center in a colleg... campus setting, with buildings of Roma... esque architecture widely spaced on ... large landscaped quadrangle and form... ing an harmonious group appropriate ...

STERLING QUALITY

YOU'LL GET BETTER RESULTS WITH STERLING

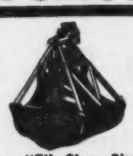
WRITE FOR LITERATURE

STERLING PUMPS



STERLING MACHINERY CORP.
4051 3 Southwest Blvd. Kansas City, Mo.

Hayward Buckets



Use this Class "E" Clam Shell Bucket for handling crushed stone, gravel, sand and other bulk materials.
THE HAYWARD CO., 48-50 Church St., N. Y.

Fast, Dependable

SHOVELS, CRANES DRAGLINES, BACK HOES

Crawler or Truck—Gas or Diesel

10 Models of 3/4-5/8-1/2-3/8 cu. yd.

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RAVENNA, OHIO
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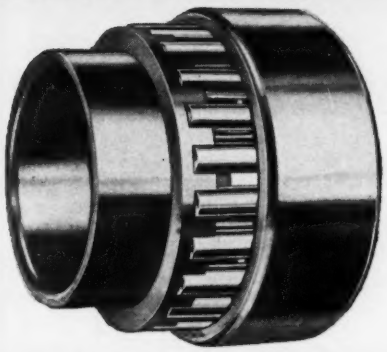
This is THE BIG INCH of Pipelines—
Greatest Capacity **of any pipeline ever built**

—and this is the "BIG INCH" OF ROLLER BEARINGS



These "Inch Series" Hyatts...like their famous pipeline namesake...have tremendous capacity... measured in tons and hundreds of tons.

And...as a further advantage...they are made in fractional size bores, for shafts from 4" diameter upwards.

Originally designed for the massive, heavily loaded, relatively slow moving oil well machinery, the use of this type of Hyatt Bearings (70,000 series) quickly spread.

Today they are serving and saving in mining equipment, industrial locomotives, power presses, pillow blocks, cranes and steel mill cars...as well as in numerous types of fighting equipment.

Keeping pace with the demands of industrial designers for the latest and best in anti-friction bearings has been Hyatt's job for fifty-one years.

The "Big Inch" is just one of the several types of Hyatt Bearings now being made. Each of them is designed for specific needs and purposes.

Call on our engineers for information about their profitable application to your products.

HYATT BEARINGS
Division of GENERAL MOTORS

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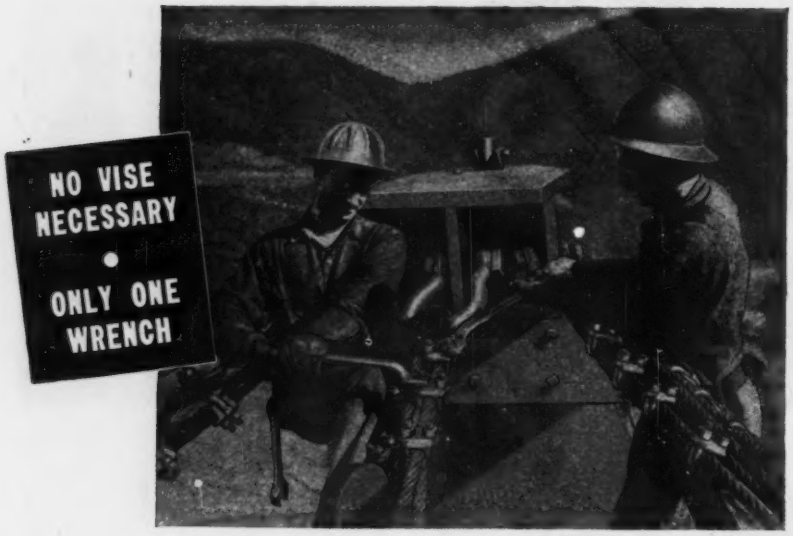
CROSBY CLIP
ease of application . .

One of the many reasons why experienced riggers prefer the Genuine

CROSBY WIRE ROPE CLIP

is because it goes on easily and quickly. PROPER DESIGN *and* PERFECT FINISH *insure that.*



60 years of PROGRESS in clip design and construction have resulted in the Genuine CROSBY CLIP — The perfect clip with the perfect grip.
Let your riggers be your guide in buying wire rope clips and you will specify the Genuine CROSBY CLIP.

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. . . Can be met through ONE reliable source when you specify *Dandux* in ordering *anything* of canvas. Tarpaulins, baskets, hampers, canvas bags and covers—when you need these or other canvas items, investigate Dandux prices and specifications *first.* You'll find it pays to standardize on Dandux.

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Manufacturers of Everything of Canvas
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a residential section have been submitted to the New York City Planning Commission by Sylvania Electric Products, Inc.

The Sylvania plan outlines a development of nine buildings, but its completion will depend on postwar conditions. If the project is approved by the City Planning Commission and the Board of Estimate, the first move would be to erect a model for a research laboratory a residence that is on the proposed site of 3[illegible] acres on Cross Island Boulevard adjoining the Clearview golf course in Queens borough, New York City.

A COMPANY all-time safety record was established by the Caterpillar Tractor Co. during the first six months of this year when the frequency rate of lost-time accident cases of its more than 17,000 employees dropped to 4.36 per million man-hours of work, so reports H. S. Simpson, safety engineer. During the month of June two other all-time records were established when only seven lost-time cases were reported and the frequency rate of lost-time dropped to 2.08.

FOUR OF THE TOP executives of the Pittsburgh Equitable Meter Co., Pittsburgh, Pa., are now active in various branches of governmental service. Col. Willard F. Rockwell, president, who has been in the army reserve over 20 years, has been serving as director of production for the U. S. Maritime Commission in Washington since April 7, 1942. Allen D. MacLean, vice president and chief engineer, is also in Washington with the Maritime Commission, serving as assistant director of production. Private W. F. Rockwell, Jr., vice president and comptroller, is in training at the Army Ordnance Officers' School, Aberdeen Proving Grounds, Md. Capt. A. E. Higgins, vice president and sales manager, a reserve officer of many years standing, has been commissioned major and assigned to active duty with the U. S. Air Corps.

J. A. MCCARTHY, president of the Pacific Portland Cement Co. in San Francisco, Calif., has announced the appointment of J. E. Jellick as sales manager. Mr. Jellick was formerly manager of the Portland Cement Information Bureau in San Francisco. Prior to that he was district engineer of the Los Angeles and San Francisco Offices of the Portland Cement Association, and for three years was manager of the Pacific Coast Offices of the Association. He is

160 Million Gallons Daily

Thomas Jefferson Pumping Station
uses four Fairbanks-Morse thirty-inch, double-suction pumps

A group of four Fairbanks-Morse thirty-inch, double-suction, single-stage, split-case pumps gives the Thomas Jefferson Pumping Station in Chicago a total capacity of 160,000,000 gallons of water daily. Installation of these pumps departs from the conventional in that suction is horizontal and discharge is vertical. Water is taken from Lake Michigan at the Wilson Avenue Crib, brought through five miles of tunnel and discharged through twenty-three miles of feeder mains. Each of these big pumps is driven by a 1200 hp. motor.

Modern pumping equipment such as is found at the Thomas Jefferson Pumping Station, saves the taxpayers of any municipality real money. In many cases, old pumps, even if as good as when installed, exact at least a 10% power cost penalty. At that rate, new pumps soon pay for themselves.

Comparatively few cities require pumps with such large capacity as Chicago; but large or small, Fairbanks-Morse builds the right pump for the job.

Fairbanks, Morse & Co., Fairbanks-Morse Building, Chicago, Illinois.

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DIESEL ENGINES · PUMPS · MOTORS · GENERATORS · WATER SYSTEMS · SCALES · STOKERS · FARM EQUIPMENT · RAILROAD EQUIPMENT

Pumps

Tanks produce results only in actual combat on the firing line.

To conserve their fighting capacity they ride to battle on Rogers Trailers, or if damaged are transported to the rear for repairs on a retriever type of trailer especially equipped to load disabled tanks.

Meanwhile, thousands of standard Rogers Trailers are serving efficiently on our factory fronts or in transporting defense equipment to various fortifications.

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LOW BED-
HEAVY DUTY
TRAILERS

ROGERS BROTHERS CORP., ALBION, PENNA.

a registered civil engineer and has been with the Los Angeles County Road Department. He has also acted as District Engineer with the Wyoming State Highway Department.

FRED W. PENNINGTON, until recently the publicity department of the Westinghouse Air Brake Co., has been appointed manager of publications and advertising for Kennametal, Inc., at Latrobe, Pa., which succeeds the McKenna Metals Co. The personnel, management, products and policies remain the same.

WORTHINGTON PUMP & MACHINERY CORP., of Harrison, N. J., has announced the acquisition of Ransome Machinery Co., of Dunellen, N. J., as a wholly owned subsidiary of Worthington. Ransome, designers and builders of machinery since 1850, manufacture concrete mixers and road paving equipment.

BALDWIN LOCOMOTIVE WORKS, Philadelphia, Pa., and its wholly owned subsidiaries, awarded subcontracts of approximately 65 million dollars on war orders in the first six months of 1943, reports Ralph Kelly, Baldwin president. Total of 1,035 subcontractors in 28 states and the District of Columbia shared in the program. Pennsylvania was first with 29 percent, Illinois second with 13 percent, and New York third with 12 percent.

THE APPOINTMENT of C. R. Osborn as vice president of General Motors Corp. was announced Aug. 2 by C. E. Wilson, president. Mr. Osborn will be in direct charge of the Electromotive Division at LaGrange, Ill. A. W. Phelps has been transferred from Electromotive to Detroit where he will be assistant to E. F. Johnson, vice president. Mr. Wilson also announced that E. B. Newill has been

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LEHIGH CEMENT HELPED MAKE THESE WINDOWLESS WALLS THAT *"Breathe"*

Modern war plants can't let weather conditions interfere with armament production. That's why you're seeing so many revolutionary developments in building . . . including the mammoth plant of the Douglas Aircraft Company.

Lehigh Portland Cement, over 100,000 barrels of it, helped form the tremendous windowless walls of this construction. A continuous *ventilating* flue, forty feet high and nearly two miles long, provides a wall that "breathes."

It is a source of satisfaction to us that in this as well as so many other important war projects all over the country, Lehigh Normal and Lehigh Early Strength Cements have been used. Lehigh Early Strength Cement contributes extra speed in making service strength concrete when extra speed is required. It makes service strength concrete 3 to 5 times faster than normal Portland cement. For full details, write the Lehigh Service Department.

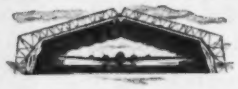
LEHIGH EARLY STRENGTH CEMENT
for **service-strength** concrete in a **hurry**

Lehigh CEMENT

LEHIGH PORTLAND CEMENT COMPANY • ALLENTOWN, PA. • CHICAGO, ILL. • SPOKANE, WASH.

Tonight...

AIR CIRCUS for "ANXIOUS AXIS"



Stupendous, colossal, relentless, devastating and terrifying.

Circus superlatives cannot begin to describe the greatest aerial show on earth. In astronomical numbers its daring performers move on across oceans, seas, islands, and continents to give final performances in Rome, in Berlin and in Tokyo.

How a show so great can be so mobile is an absorbing story in itself. Some of it can now be told. Combat hangars for instance... how can they keep up with a battle front that jumps an ocean or a sea over-night?

That very problem was put to Butler engineers and skilled craftsmen while they were running a 3-shift production line on steel mats which hook together and in a few hours make an airfield runway; while they were up to their ears in the production of a complete array of portable steel buildings for airports and gasoline tanks for refueling warplanes and mechanized units.

In time to make a certain convoy, they came up with the right answer. It is the Butler Combat Hangar so simply engineered that ninety inexperienced soldiers can erect a 130x160 foot unit in 18 hours on sand or ice or uneven terrain. The parts that form its columnless, hinged arch, steel frame, bundle so compactly they are loaded into air transports and flown in. On a system of pulleys and ropes its flame-proofed, bomb-resilient canvas envelope is raised and suspended under the steel-frame. Over the framework camouflage or an outer wall of steel or wood may be attached for greater protection and comfort.

Tomorrow . . . Modern Airports Will Mark The Thriving Communities.

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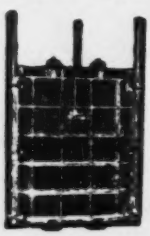

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Also flap and mud valves, shear and filler gates. Dependable equipment since 1840.

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made general manager of the Allison division, Indianapolis, Ind.

ADOLPH G. SCHROEDER has been appointed manager of the machinery department of Iron & Steel Products, Inc., Chicago, Ill., succeeding A. E. Waleski, resigned. Mr. Schroeder has had many years of experience in the machinery and equipment lines.

E. I. EVANS, manager of the Southern district, Republic Steel Corp., has announced the appointment of Jones Cahill as open hearth furnace superintendent at the Gulf division operations in Gadsden, Ala. Cahill was formerly open hearth superintendent at the corporation's Youngstown, Ohio, operations.

THE INGALLS IRON WORKS CO., of Birmingham, Ala., has announced the appointment of C. Harold Louree as district manager of the New Orleans sales office. Mr. Louree was with the Austin Co. at Oklahoma City as designing engineer, and previous to that he was with the Patterson Steel Co. of Tulsa, Okla., as sales engineer. He is an associate member of the American Society of Civil Engineers and the American Welding Society.

RECENTLY at Hill Field, Ogden, Utah, three structural steel workers and their foreman, employees of Bethlehem Steel Company's division of fabricated steel construction, were unloading a carload of structural steel as an army bomber crashed on the roof of a nearby hangar. A great hole was torn in the roof, and one of the plane's engines, tearing loose from its fastenings, fell to the ground. Rushing to the scene of the accident, these workers found the pilot precariously clinging to a steel member of the hangar's roof support system about 90 ft. above the floor. Dazed by shock he might have fallen at any instant, but the structural steel men climbed the 90 ft. and rescued him just in time.

In the letter that was subsequently received commending the men for their good work, Col. Morris Berman, commanding officer of the control area, said: "It is highly possible that these men were responsible for saving the life of this pilot. Had they not come to his rescue quickly, it is extremely likely that in his dazed condition he would have fallen to his death. Because of their skill in climbing steel work and through their quick response to the emergency the pilot was saved from further injury and probable death."

The three men were William McGowan, E. O. "Bud" Eastland and Art Gibbens, with their foreman, "Champ" Johnson lending assistance from the ground.

AMERICA'S GREAT AUTOMOTIVE INDUSTRY GIVES TOTAL COOPERATION FOR TOTAL VICTORY

. . . with *"Work Together — Win Together"* as the universal battle cry of the day

Chevrolet always has been proud of its membership in the automobile industry—but never before quite so proud as it is today. . . . For motor car manufacturers have performed miracles on behalf of America's war effort, and they have accomplished these miracles by utilizing their skills, their experience and their resources to turn out the maximum of war material for the common cause. . . . For its own part, Chevrolet is glad to report that it is serving others, just as others are serving Chevrolet—and all for the advancement of the war effort. . . . Major contractor, building aircraft engines, anti-aircraft guns, high-explosive and armor-piercing shells, military trucks and other products for our armed forces—Chevrolet also is a major supplier, manufacturing parts by the million for more than 120 other important war producers. . . . Total cooperation—total teamwork—is the key to total victory for all of us.

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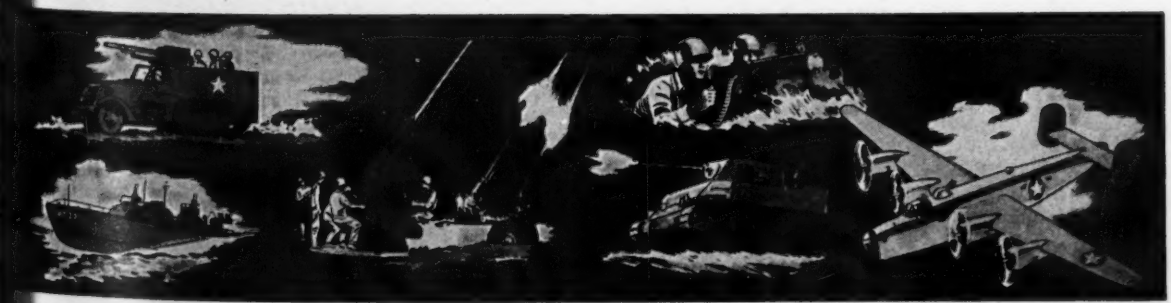
The products illustrated are only a few of the great many produced by the Automotive Industry.

CHEVROLET
DIVISION OF
GENERAL MOTORS



UNDER THIS
Carey
BUILT-UP ROOF
Millions of Pounds of Burley Tobacco are Warehoused and Sold....

Under the Carey Built-Up Roof which covers this large tobacco warehouse at Maysville, Ky., auctioneers chant their familiar jargon. Maysville is the second largest Burley tobacco market in the world with sales of approximately 30,000,000 pounds annually. Protection against weather during the storing and handling of tobacco is of prime importance. It is therefore significant that Carey Roofs are popular in the Burley belt.

Carey Roofs likewise are serving industry generally throughout the nation, including huge war plants where roof protection of the utmost dependability is vital.

Carey Roofs have a reputation of wearing longer, at lower yearly cost. They have earned this reputation because they are individually engineered and built to withstand such factors as salt air, chemical fumes, or any other adverse conditions under which they must serve.

You're always SAFE with a CAREY Roof. A nationwide organization is ready to serve you.

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Broaching Development—A 16-page, 3-color booklet entitled "A Quarter Century of Broaching Development" points out the tremendous growth of broaching in the past quarter century. Twenty-five years ago no broaches were being produced in the Detroit area, broaching speeds current in industry were then about 6 ft. per minute in contrast to today's 30 ft. per minute, and no standards of modern broach design or broach use had been established.—*Colonial Broach Co., Detroit, Mich.*

Incentive Guide Book—Publication of a new booklet, "Ideas That Work to Win", a guide to management for establishing and conducting various incentive measures to stimulate production in Navy contract plants, has been announced by Rear Admiral C. H. Woodward, USN (Ret.), Chief of the Navy Industrial Incentive Division.

Defining industrial incentives as "those ideas which rouse the fighting spirit of American workmen and translate that spirit into increased or improved war production," Admiral Woodward declared that the booklet deals with the human factors affecting production.

The booklet catalogs various means whereby plants can on their own initiative or in cooperation with the Navy's Industrial Incentive Division, promote more and better production. *Industrial Incentive Division, Navy Department, 2118 Massachusetts Ave., N.W., Washington, D. C.*

Positive Lubrication—An 8-page bulletin describes an improved method of providing positive lubrication to a group of bearings from a central distributing block. This system delivers lubricant to individual bearings under pressure. With this plan, however, oil or grease is supplied to the multiple valve blocks by means of a manual or power-operated portable gun. By making a single connection the operator delivers an exact measured charge of lubricant to as many as ten bearings at a time. Each bearing receives the correct amount, regardless of its location or condition.—*The Farval Corp., 3293 East 80th St., Cleveland 4, Ohio.*

Metallizing Process—A new 40-page catalog deals with all phases of the

WIRE ROPE NETWORK

CARRIES BAD NEWS FOR AXIS!

U. S. Maritime Commission photographs.

Shipyards and ships have been and are being built faster than ever before because construction men and shipbuilders were quick to throw overboard time worn precedents, inhibitions and usages. For example, instead of assembling the myriad pieces of each ship on the ways, huge sections of ships are factory fabricated —then swung on WIRE ROPES to the ways and welded into position in a fraction of the time old methods required.

Already, hundreds of Liberty Ships are veterans of the convoys. On a network of WIRE ROPES swing huge loads of fighting equipment to fill their holds and stack their decks in a race against loading time limits once thought impossible.

Yet, these are only a few of the countless ways in which the wire rope network carries bad news to the axis. Its wave length is limitless. It reaches deep into the bowels of the earth to bring up ores, oil and coal. It reaches a mile and a half high into the air to anchor barrage balloons for snaring enemy bombers.

The best of everything goes to war first. So it is that Union Wire Rope is a veteran of the war. Each star above our Navy E signifies another six months of star performance in war production. To the very limit permitted under conditions of war our skilled craftsmen and precision machines also convert the finest of steel into tough tendons for all types of man-hour saving machines essential in the prosecution of the war on the home front.

THREE TIMES WON FOR EXCELLENCE IN WAR PRODUCTION

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SEND FOR ROPE DOPE • Tells how to make wire rope last longer—how to handle and install it—how to socket or splice—and a wealth of other helpful information. Engineering information supplied without obligation.

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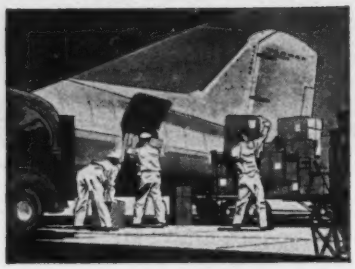

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Effective July 15th, Air Express rates within the United States were substantially reduced — many reductions ranging as high as 12½%, depending on the weight of the shipment and the distance it moves. As a result, the average saving to shippers amounts to 10½%.

Increased volume of Air Express traffic stimulated by wartime demands on this fastest form of shipping service—accompanied by peak efficiency in handling—has made it possible to pass these savings along to shippers of air cargo.

So now, more than ever, *it pays to ship by* AIR EXPRESS!

NOTE TO SHIPPERS: To keep costs down—*pack compactly*, obtaining best ratio of size to weight. To insure fastest delivery—*ship when ready*—as early in the day as possible. **ASK** for our new 1943-44 CALENDAR-BLOTTER. Write Department PR-10, Railway Express Agency, 230 Park Avenue, New York 17, New York.

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metallizing process. The book shows how this process is saving time, money and precious metals in production, maintenance and corrosion prevention. Information in the book is classified according to industry and covers every major field in which metallizing is effecting economy in time and money in the maintenance and repair of costly and hard-to-replace equipment.—*Metallizing Company of America, 1330 West Congress St., Chicago, Ill.*

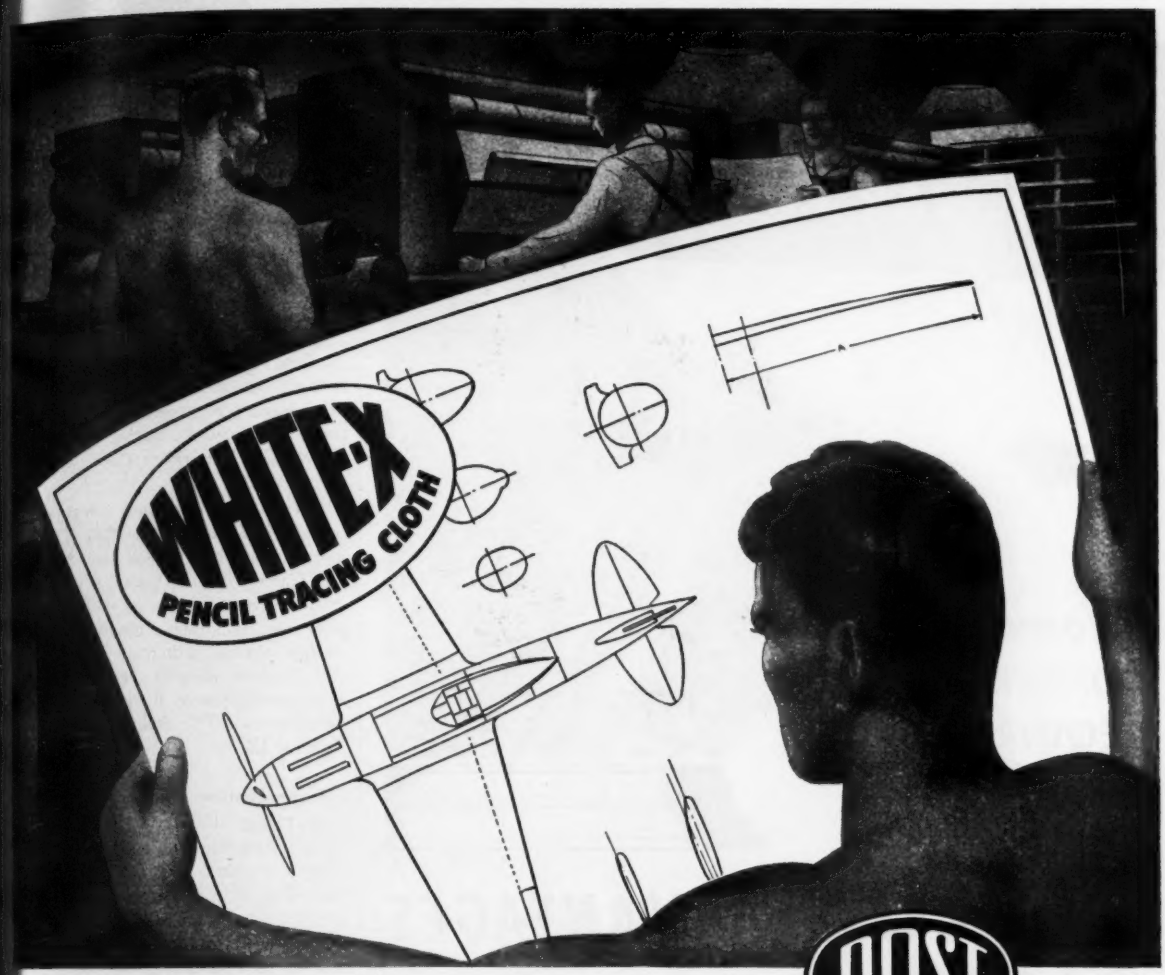
Acid-regenerated Zeolites—This paper discusses and presents data on characteristics of the newly developed acid-regenerated carbonaceous zeolites. The report is of value to users of this type of apparatus or engineers and designers who are considering their use. The paper covers a series of tests giving much research data and also formulates a means by which the results can be predicted from the accurate analysis of the raw water supply.—*Cochrane Corp., 17th and Allegheny Ave., Philadelphia 32, Pa.*

Temperature Records—Anyone who needs a multiple-point Micromax recorder which will draw on one chart and without excessive overlapping temperature records which normally occur close together, should find of interest the contents of a new 6-page folder. It describes split charts which are divided into two or three vertical sections. They keep similar operating temperature records separated yet parallel so that comparison is easy. Among the numerous full color reproductions of actual chart records is a full size "24 hour tear-off" chart section. The name of the publication is "New Ease in Handling Multiple Point Charts."—*Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia 44, Pa.*

Motor Maintenance—A new catalog illustrating ball bearing motor end bells tells how these products are used for the conversion of sleeve bearing electric motors to ball bearing operation, resulting in longer bearing life and less maintenance time and material. The title of the catalog is "Electric Motor Maintenance."—*Keystone Electric Co., 1220-1230 Ridgely St., Baltimore, Md.*

Diesel Maintenance Plans—To keep essential power-generating plants operating at maximum output, the "Victory Maintenance Plan for Diesel Electric Plants" has been developed through the cooperative effort of the diesel engine manufacturers and the Westinghouse Electric & Mfg. Co.

Prepared as a portfolio, this plan includes an 18-page operating guide booklet that covers complete information on the necessary steps for maintenance and inspection, mechanical and electrical check charts based on frequency of in-



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The greater use of light-weight pipe to handle your piping jobs better, easier and more economically, promises to be a war by-product that will work wonders in the post-war period.

The performance of Naylor light-weight pipe on the battle fronts, plus the research and further development constantly in progress point the way to the solution of many piping problems on the construction jobs of the future.

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ONLY NAYLOR GIVES YOU ALL THESE PERFORMANCE ADVANTAGES

- Light weight saves steel
- Accurate in diameter
- Concentric ends match correctly
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spection, and a sample form of a recommended diesel engine operating log which when filled out will serve to determine the proper scheduling of inspection intervals to meet requirements of individual plants.—*Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.*

Industrial Instruments—This bulletin contains general information on industrial instruments for controlling and recording war-time processes. The bulletin is virtually a buyers' guide of air and electric operated controllers, recorders, indicators, and telemetering recorders and controllers. Bulletins covering each type of product are listed for those interested in further details.—*The Bristol Co., Waterbury, Conn.*

Water and Sewage Treatment—A series of eight valuable 8-page and 16-page bulletins has been issued covering equipment of interest to all engineers and others having to do with waterworks and sewerage, as follows: mixing equipment, sludge removal, grit removal design, iron and carbon dioxide removal, screens, aeration equipment, flocsettler, and rotary distributors.—*The American Well Works, Aurora, Ill.*

Impregnation and Surface Coating—A 4-page illustrated bulletin on colloidal graphite for impregnation and surface coatings has just been released. This is a detailed discussion of the impregnating capacity of colloidal graphite dispersions and the application and results of impregnation and surface coating of colloidal graphite for various industrial products. It includes the reasons for colloidalization of graphite for this purpose and notes on the methods used to impregnate materials.—*Acheson Colloids Corp., Port Huron, Mich.*

Panel Connectors—The connectors described in this folder are well engineered for assembling non-metallic ducts for heating and ventilation to conform with the restrictions now in force as to the percentage of metal that can be used for such units, and to meet requirements for non-corrosive duct work. They have been carefully designed to offer definite advantages over the numerous makeshift methods developed in the period of emergency.—*Dravo Corp., Pittsburgh, Pa.*

Light From Floors—A new type of light-reflecting floor installed in aircraft plants is described in a new 24-page booklet "Light from Floors Speeds War Production."

Built of concrete made with white portland cement instead of gray portland cement or other darker materials, these light-reflecting floors become giant reflectors instead of giant absorbers of light. According to the text this better

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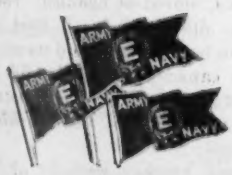

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Eliminating Sewer Clogging—Sew... age ejectors and comminutors are d... scribed in a new folder. The commin... tors installed ahead of sewage pumps c... up coarse matter that otherwise wou... cause pump clogging.

In the case of disposal into bodies o... water, the comminuted solids settle rap... idly, thus preventing shoaling of un... sightly matter on beaches, shores o... banks.—*Chicago Pump Co., 2300 Wa... ram St., Chicago, 18, Ill.*

Diesel engine—This booklet includ... a brief history of the manufacturer's ... background, together with particulars o... design, manufacture and service facil... ties applicable to their entire commercia... line of marine and stationary diesels. ... Included is a loose leaf supplement sho... giving detailed operating costs data fo... typical municipal plants.—*Fairbanks, ... Morse & Co., 600 S. Michigan Ave., Chi... cago 5, Ill.*

Inert gas generators—This is an 8-... page booklet printed in two colors, with ... numerous illustrations. It describes inert ... gas generators designed to produce a ... mixture of nitrogen and carbon dioxide ... with a small percentage of water vapor ... and less than 1 percent of either oxygen ... or carbon monoxide, as desired. This is ... claimed to be a desirable means for ... furnishing inert gas at a low cost. It ... has been found advantageous in industrial ... processes wherever flamable gases, or ... liquids with flamable characteristics, are ... treated, stored or handled. These gener... ators, either gas or oil fired, are avail... able in both portable and stationary types, ... for a capacity range of 1,000 to 35,000 ... cfh at a pressure of 3 lb.—*Roots-Connersville Blower Corp., Connersville, Ind.*

Glass blocks—Methods of replacing ... worn-out windows with glass block are ... described in detail in a new booklet. ... Photographs of typical installations are ... included along with specifications, techni... nical data and typical construction de... tails. Photographs and details of many ... industrial installations are said to show

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that the use of glass block to repla worn-out sash results in the followi advantages: greatly reduce heat loss a heat gain; savings in critical materia improved lighting; elimination of infil tion of dirt and dust; reduced main nance costs; cleanliness; and improve appearance.—*Insulux Products Divisio Owens-Illinois Glass Co., Toledo, Oh*

Pulverized coal—A bulletin describ in detail pulverized coal equipment a includes a number of interesting d signs of modern systems utilizing au matic temperature and pressure control The equipment described may be quick installed to replace fuel oil consumin systems. Operating data reveals maj economies.—*The Amsler Morton Co. Pittsburgh, Pa.*

Welder's guide—A handy and valuabl vest pocket guide for welders shows wh is wrong with different types of faul welds, and how to correct those faul It suggests and illustrates all kinds o joints, fillet welds, and how to cut elec trode waste. It explains the three essen tials of proper welding procedure, an completely illustrates welding symbol There is also a check chart on weldin machine troubles, a "How to Find" lis and handy reference information on deci mal equivalents.—*The Hobart Brother Co., Troy, Ohio.*

Revolving cranes—An unusually hand some 90-page catalog is that describin the "American Revolver" cranes. There are many fine photographs showing the apparatus at work in construction, indus trial material handling, stevedoring an marine service. The manufacturers ca the American Revolver a "one-man tas force."—*American Hoist & Derrick Co. St. Paul, Minn.*

Heat transfer.—An 8-page illustrate folder describes this manufacturer's wid range of heat transfer equipment, includ ing supercharger intercoolers, heatin coils, oil temperature regulators, engin jacket coolant radiators, engine and com pressor cooling, heat exchangers—li marine and industrial service, and pro ducts for industrial air conditioning.— *Young Radiator Company, Racine, Wis.*

Motor Maintenance Handbook.—This tells how to keep motors and generator operating continuously at peak efficienc without dismantling. Other equipment is also illustrated and described, includ ing: Industrial electrical equipment variable speed transmissions, machine tool accessories, wiring devices and tools and a rechargeable battery for flashlights. *Ideal Commutator Dresser Co., Sycamore, Ill.*

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naturally you wouldn't be so silly! A doctor ould probably advise you to give the poor ouse a pill and put it to bed.

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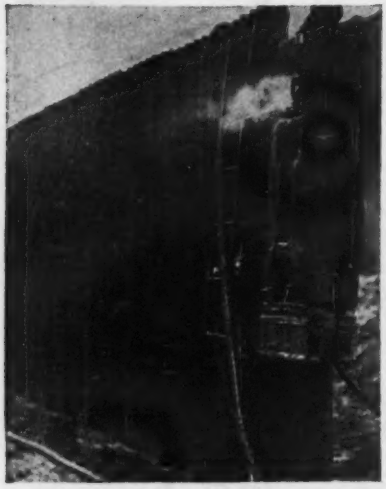

Sometimes metal sheeting is a military *must* on vital war projects.

Just such a job recently required 37,000 square feet of steel sheeting. Figured with ordinary hot rolled sheeting, about 534 tons of metal would have been used. Doing the work with light-weight ARMCO Sheeting required only 179 tons — a saving of 355 tons of precious steel, or enough to build 22 light tanks.

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Gear assembling—In view of the tremendous growth in us of cone-drive area-contact gearing, this manufacturer has published an instruction manual on how to assemble such gearing in housings, how to check assemblies, etc. Included in the manual are detailed instructions as to the simplest methods to follow to assure maximum efficiency of operation as well as correctness of assembly. Two methods are given—one for assembly in low production, one for assembly in high production. Assembly checking instructions are similarly detailed.—*Cone-Drive Division, Michigan Tool Co., Detroit 12, Mich.*

Pipe threading machines.—Four complete manuals covering the operation and maintenance of portable and stationary pipe threading machines, as well as spare parts for them, are available. Each one contains an operator's manual, a maintenance manual and a spare parts list.—*The Oster Mfg. Co., East 61st at Carnegie Ave., Cleveland, Ohio.*

MEN AND JOBS

Lt. D. H. Helmich, for many years county engineer at Birmingham, Ala., has just completed his six weeks of basic training in the Navy. Lieutenant Helmich, serving with the Seabees, volunteered in May and has been stationed at Camp Peary, Williamsburg, Va., and will remain at that station several weeks longer as an instructor. Lieutenant Helmich, who served in the army as a lieutenant during the first World War, saw active service in the battles of the Argonne and St. Mihiel.

Milton M. Kinsey has been appointed director of public utilities at St. Louis, Mo., filling the vacancy caused by the death of M. H. Doyne. Mr. Kinsey had been chief engineer of the Missouri Public Service Commission, and will be succeeded in that position by **Ralph E. Duffy** of Jefferson City.

Herbert J. Morrison, former city engineer of Miami, Fla., has been promoted to first lieutenant at Paterson Field, near Colorado Springs, Colo.

The following have resigned from Frederic R. Harris, Inc., consulting engineers, New York City, and have reported for active duty with the United States Navy: Warrant Officer Ralph Sandor, Ensigns Joseph Beck, Murray Falkin, George Fox, John Picco, and Sherman Glass, and Lt. Comdr. Ben Berman.

Engineers for postwar planning in Kansas City, Mo., have been appointed by the city manager. They were **W. D.**

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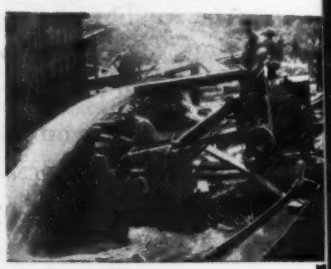

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Contractors standardizing on Gorman-Rupp Pumps are getting extra hours instead of costly shut-downs due to pump failures. There's a *definite reason.* More dependable. No priming jet to clog. No control valve to jam. This is important today when every piece of equipment has to take a beating. Let your distributor show you why more contractors are switching to Gorman-Rupp's every day.

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WHATEVER your requirements, there is a Cleveland Paving Breaker exactly suited to the job. The 80 lb. C7 is the right tool for average work—two C7's run from a No. 85 compressor. For heavier work, use the C9; it is 2 lbs. heavier, but uses no more air. C9 is a slugger that licks the toughest, reinforced concrete. For light work, trimming, etc., try the C10, the little fellow with the big wallop. Three C10's run from a No. 85 compressor. Model C11 is the 58-pound machine with the long stroke and the heavy "slugging" blow—a favorite wherever used. Extremely economical as to air consumption.

Among accessories you can't beat "Clevaloy' chisels, moils and miscellaneous paving breaker tools. Try the 14" narrow chisels, they cost no more than moils, but cut faster. Then specify tough, durable Cleveland "Veribest" air hose. Finally, connect it with Cleveland quick-acting Type "A" hose couplings, and you are all set for the toughest paving breaker job.

Ask for Bulletin 128 on Cleveland Paving Breakers

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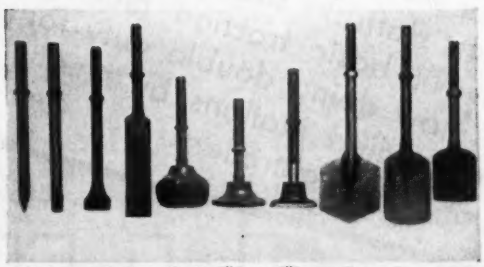

Moil Chisel | Narrow Chisel | Wide Blade | Digging Blade | Sheeting Driver | 7" Tamper Bar | 5" Tamper Bar | Clay Blade | Clay Spade | Asphalt Cutter

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★ *Place a stiffer mix faster.*
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★ *Get a better bond with reinforcement and a stronger water tight job.*
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8 swivel-fitted attachments, quickly interchangeable with the vibrating element are available for *Wet Wall Rubbing, Form and other Sanding, Sawing with Circular Saw, Wire Brushing, Grinding, Drilling in Wood, Brick, Steel or Stone, Pumping and Sharpening Tools.* With the present scarcity of time, labor and materials and a competitive future facing you, the need for this equipment was never greater. Write at once for full information.

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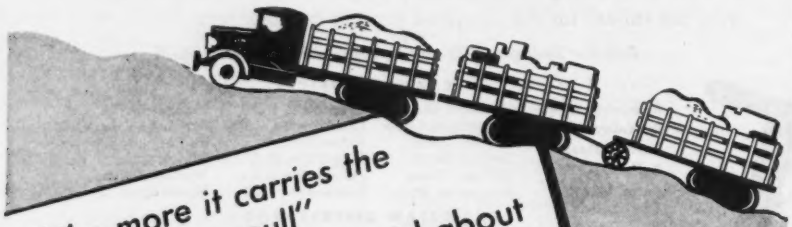

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SINCE 1916

LINN

CONTOUR-FOLLOWING TRACTION

THE
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MORRIS NEW YORK

Bryant who has been regional consult for the Department of Commerce, will be principal planner; and **John Picton** of the regional office of the National Housing agency who will be chief planning engineer.

Charles L. Goodwin, Raleigh, N. C., has been promoted to the rank of captain at Camp Edwards, Mass., where he is with the Army Engineer Amphibian Command. He is a graduate of North Carolina State College.

William Cramer Cotten, Jr., of Waco, Tex., civil engineer for the Texas State Highway Department for ten years, has reported for duty with the construction battalions at Camp Peary, Williamsburg, Va.

Kenneth K. King, director of the water department of Kansas City, Mo., has been appointed Public Works Director and Melvin P. Hatcher, chief engineer of the water department, was made water director. Mr. King succeeds the late Arthur C. Everham.

Carden T. Heeney, bachelor of science in civil engineering from McGill University, Montreal, has been named assistant water works engineer for the city of Ottawa, Ont.

W. D. Barrows of Providence, Ky., has been reappointed by Governor Keen Johnson for a four-year term as a member of the Kentucky State Board of Registration for Professional Engineers.

John H. Inskeep has resigned his position in the office of the county engineer of Logan County, Ohio, to accept a commission as ensign in the Civil Engineer Corps, USNR. He is now located at Camp Peary, Va.

Lt. William W. Aultman was recently made an executive officer of the naval post at Dutch Harbor in the Alaskan theatre of operations. The lieutenant was formerly sanitary engineer for the Metropolitan Water District of Southern California in charge of the softening and filtration plant.

Charles G. Prahl (CEC), USNR, naval officer in charge of construction at the Marine Air Base at Edenton, N. C., since July, 1942, has been promoted to the rank of lieutenant commander from that of lieutenant. He received his civil engineering degree from Oregon State College and worked for some time with the Bureau of Reclamation on the Grand Coulee Dam.

A. H. Sorenson, chief engineer, and **J. P. Bishop,** assistant, both of the

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SIMPLIFY Load Stresses *the* ROLLWAY *Right-Angle Way*

By carrying every load—both radial and thrust—at right angles to the roller axis, Rollway's solid cylindrical roller bearings automatically split the load into the two fundamental components of *pure* radial and *pure* thrust. That reduces the load stresses per roller and per bearing. It eliminates all compound loads, and all oblique resultants. You get more accurate engineering of the bearing to the job. You get a bearing which lasts longer under heavier loads and continuous running. Downtime for maintenance and replacement is substantially reduced.

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- **Carry all radial loads at right angles to the roller axis.**
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Rollway has developed a large list of types of solid cylindrical roller bearings in both SAE and American Standard metric sizes, each having definite characteristics to meet exacting needs. Take full advantage of this wide choice of types and sizes. Let Rollway's specialized bearing experience help you in your choice. Just send a sketch or detailed description of your machine design or bearing problem. A confidential bearing analysis and recommendation will be returned to you without cost or obligation.

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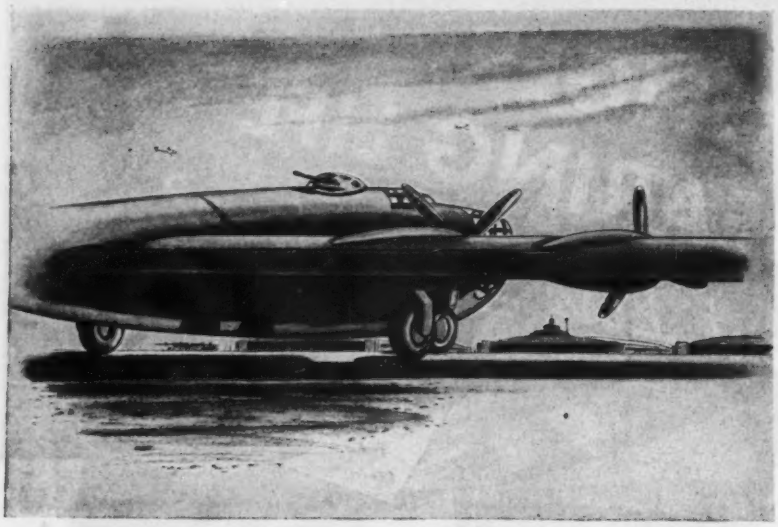

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The NEW Peelle Plydoor fits any opening, quickly installed, easily operated and economical, too. Prefabricated under a new principle of wood construction, stronger per pound than steel. So light it can be manually operated—glides up out of the way—or rolls back like a telescope into a self-contained unit. Can be added easily to buildings already constructed. And, best of all, you can get your NEW Peelle Plydoor now!

Take advantage of the Peelle experience and skill. It will pay you to let us send you complete data!

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BUILDINGS AND VIADUCTS

MOUNT VERNON, OHIO

Civil Aeronautics Authority, are in charge of the grading and drainage work on the 600-acre county-city airport at Greenville, N. C., preparatory to the paving of runways for the CAA. **W. H. Fox** is superintendent for the contractors on the project. Blythe Brothers of Charlotte, N. C.

Robert Blais, senior engineer on the headquarters staff of the Canadian Department of Public Works, at Ottawa, has been appointed assistant chief engineer of the department, succeeding R. deB. Corriveau, who recently retired. K. M. Cameron is chief engineer of the department.

Col. William K. Dickson has just been made chief of the supply and service division at Fort Bragg, N. C. Before entering the army, Colonel Dickson was a civil engineer at Charlotte, N. C.

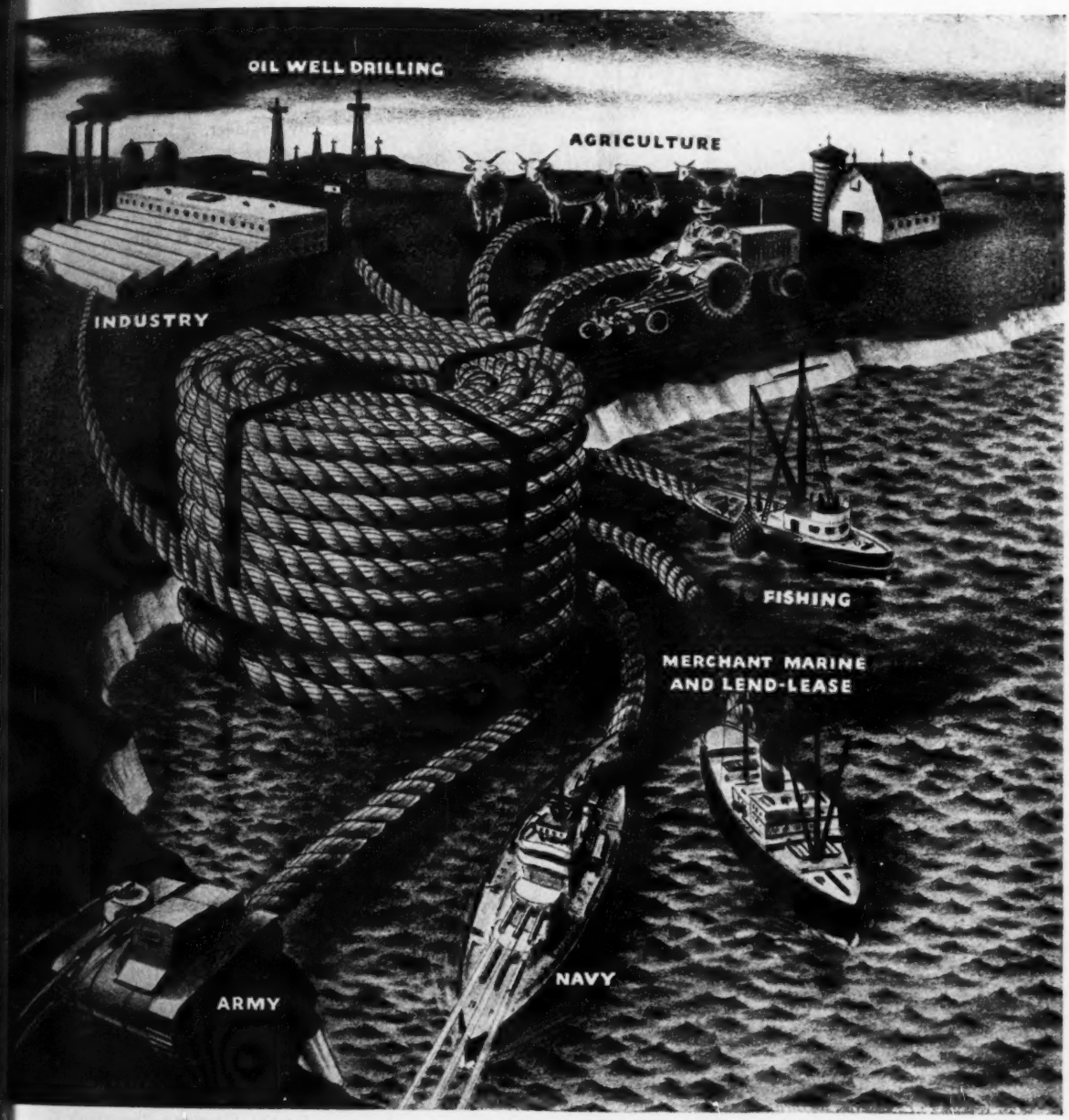
William Oswald Cudworth, assistant engineer, maintenance-of-way, Eastern Lines, Canadian Pacific Railway, has been appointed to head his department in Toronto as engineer of maintenance-of-way, Eastern Lines, succeeding Lt. Col. Blair Ripley, who has been assigned to special duties. Mr. Cudworth will be succeeded in his post by **George W. Miller,** at present an assistant engineer in the chief engineer's office, Montreal.

Wade W. Shidler, former city engineer of Alliance, Ohio, has assumed his new duties as Stark County resident engineer for the state highway department.

Maj. A. B. Smith has been named Spokane area engineer for the U. S. Army Corps of Engineers, succeeding Maj. C. Arthur Nauman, who was transferred to active service. **Maj. William H. Baker,** who has been serving as district control officer and officer of civilian war housing surveys at Seattle for the U. S. Army Corps of Engineers, has been transferred to Fort Belvoir, Va. **R. H. Baldock,** Oregon state highway engineer, and **Charles H. Stricklin,** Oregon state engineer, have been appointed by Governor Earl Snell to serve on the newly created Northwest States' Development Association.

Commissioned a captain in the provost marshal's department of the Army, **T. J. Rice,** deputy engineer in charge of the division of maps and research of the Bureau of Engineering under City Engineer Lloyd Aldrich of Los Angeles, Calif., has left for Fort Custer, Mich. Captain Rice, who served in the 23rd Engineers in World War I, was active in American Legion circles. He had been an employee of the Engineering Bureau for 20 years.

Harry L. Dygert, who has served Albany,



SO MUCH TO DO...SO LITTLE ROPE

YOU KNOW the current rope picture . . . you know how little rope you have to do the big job you're doing. Obviously, then, your most important move is to *conserve the rope you now have!*

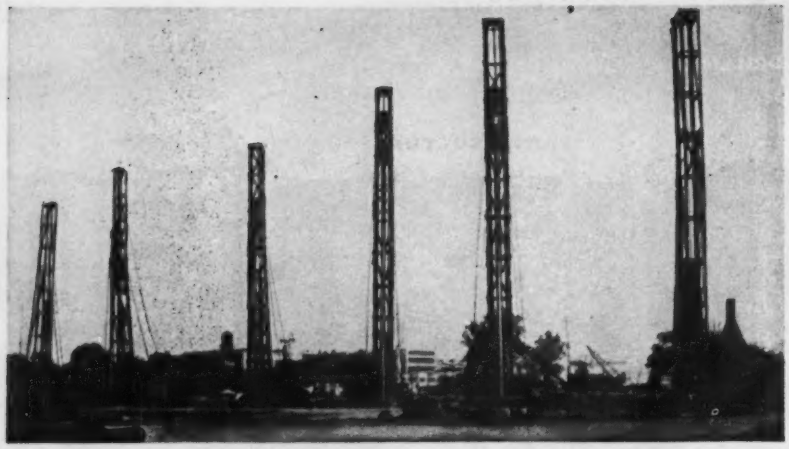
Make sure your co-workers are perfectly familiar with *all* the conservation practices that are *so essential* to long rope life.

Write us for copies of Plymouth's free booklet "Making Rope Last Longer" to distribute among your men.

PLYMOUTH

Rope FOR INDUSTRY

PLYMOUTH CORDAGE COMPANY, North Plymouth, Massachusetts and Welland, Ontario.



WESTERN

WESTERN FOUNDATION CO.
WESTERN CONCRETE PILE CORP.
DRILLED-IN CAISSON CORP.

308 W. WASHINGTON ST.
CHICAGO, ILL.

52 VANDERBILT AVE.
NEW YORK, N. Y.

WYTEFACE "A"
TRADE MARK
STEEL TAPES

K&E
REG. U. S. PAT. OFF.

Easy-to-read, *raised* black graduations on crack-proof white surface . . . resist abrasion from rock, sand, scraping over rails, pipe, concrete, etc. In all sizes and types—in cases or reels. Ask your dealer—or write for catalog.

I'LL TAKE THE WHITE ONE EVERY TIME!

GRADUATED
IN INCHES OR TENTHS

EST. 1867
KEUFFEL & ESSER CO.
NEW YORK · HOBOKEN, N. J.
CHICAGO · ST. LOUIS · SAN FRANCISCO · LOS ANGELES · DETROIT · MONTREAL

Calif. for 14 years as city engineer and building inspector, has resigned. **Ulric F. Grey,** office engineer of the city of Berkeley building department, has been appointed to succeed Dygert as Albany city engineer.

Joseph Tice of Rison, Ark., has been named bridge and drainage supervisor for Arkansas highway district No. 2, succeeding W. E. Tillman.

Capt. Hillery T. Rudder, city engineer and street commissioner of Pine Bluff, Ark., for ten years, has been promoted to major in the Chemical Warfare Service at the Pine Bluff Arsenal.

H. G. Angell, who in recent years had been with the British Admiralty in England and Bermuda, has now accepted a position with the Royal Canadian Naval Services as assistant district engineer in Newfoundland.

Kent Brown, Fort Smith, Ark., resident engineer on access roads to the Walnut Ridge auxiliary airport roads, and an employee of the Arkansas state highway department for 15 years, has been named postwar parks road engineer. Mr. Brown will be succeeded at Walnut Ridge by **Ott Tinsley** of Paragould. Mr. Tinsley has been with the highway department as resident engineer for several years.

Harry H. Turner, Jr., engineer in the city engineer's office at Columbus, Ohio, has been provisionally appointed city traffic engineer to succeed J. Robert Guthrie who is on leave of absence as a lieutenant in the Army.

The promotion of **Maj. Robert W. Green,** structural engineer of Birmingham, Ala., from the rank of captain, was announced recently "somewhere in England" by Maj. Gen. J. F. Miller, of the Eighth Air Force Service Command.

Ross E. Wilson, formerly chief engineer for the Firestone Plantations Co. in Liberia, West Africa, has been named general manager of the 100,000-acre development. Wilson is a 1925 graduate of the University of Akron and joined the Firestone Plantations Co., a subsidiary of Firestone Tire & Rubber Co., the same year as resident engineer on the preliminary layout of the plantation in Liberia. He soon became group engineer and, except for a short period spent in supervising building construction for Firestone here has been employed on the plantation work ever since.

Edmund Kuhlman, executive vice president of the Builders Association of Metropolitan Detroit, and **Branson V. Gamber,** member of the architectural firm of Derrick & Gamber, Inc., have been appointed to Detroit's City Plan Commission.

The Care and Maintenance of Rock Crushers

Ten Time and Money-Saving Maintenance Rules:

No. 5 of a series of advertisements published in the interests of national economy and to aid those users of crushing equipment unable to secure new units during the emergency.

1. Be sure there is no play in side bearings. Tighten locking nuts with a blunt chisel and hammer, as illustrated.

2. Before shutting off power, be sure that machinery is cleaned of all stone or gravel.

3. Keep your equipment clean and free of dirt and excess grease.

4. Tighten all loose nuts and bolts every morning or every night, and check them periodically during the day. Make a thorough check after moving to a new location. Loose parts cause rapid wear or serious breakage and costly delays.

5. Crusher and chassis should always be kept level

6. The key wedge should be kept close to the jaw. Insert shims behind wedge if necessary. Check wedge daily to be sure that it is tight; and that movable jaw remains centered.

7. Always adjust movable jaws when crusher is running empty, until they touch lightly. Then back them off slightly for clearance. Never allow them to pound. Tension spring should be just loose enough to allow free operation.

8. Don't raise or lower the adjusting wedge enough to cause a tilting in the toggle plate bearing wedge. Use a longer or shorter toggle to get the desired opening at the discharge opening of the jaws.

9. Be sure toggle seat on pitman is tight.

10. Be sure to use genuine parts—and see that they are properly installed. Follow instruction sheets or consult manufacturer.

UNIVERSAL ENGINEERING CORP.

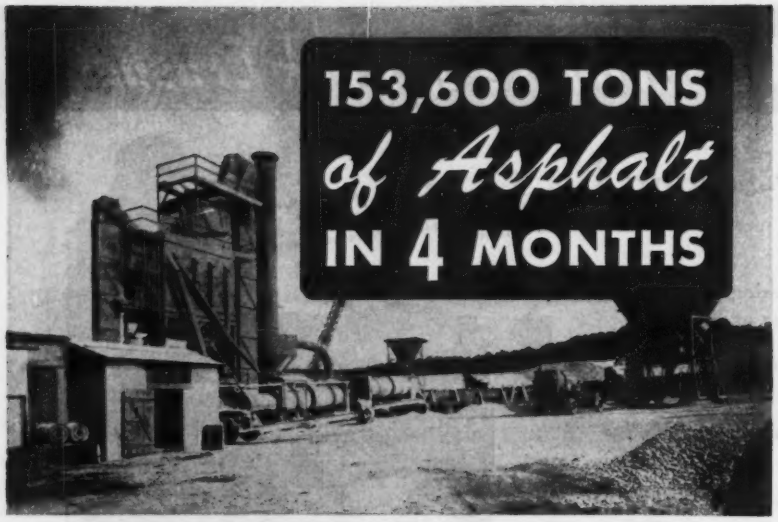
Formerly Universal Crusher Co.

633 C Ave. West **Cedar Rapids, Iowa**

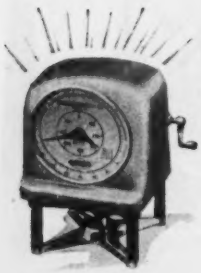
They're giving their lives—
let's lend our money!

UNIVERSAL

CRUSHERS, PULVERIZERS, COMPLETE PLANTS, SPREADEROLLERS, PORTABLE ASPHALT PLANTS



H & B PLANT AVERAGES 100 TONS PER HOUR
– Bad Weather and All – *On Ordnance Project*



THE
"Brass Brain"
(FLUIDOMETER)

This automatic metering system saves time, materials — insures uniformity. For all types of plants.

● With this Hetherington & Berner plant, the Hunkin-Conkey Construction Co., of Cleveland, produced 153,600 tons of asphalt in four months on the Ravenna ordnance project. The schedule called for 100 tons per hour for a 20 hour day—bad weather and all. This production is typical of the way in which H & B mixing plants are helping speed the building and maintenance of roads that lead to Victory. H & B plants are available today, of course, only for essential military projects. The H & B factory itself is engaged almost 100% on war work, but H & B owners are assured of dependable service on parts and repairs.

HETHERINGTON & BERNER Inc.
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LOAD TESTS—TEST PITS

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18 East 48th Street New York, N. Y.

PILE HAMMERS
and
EXTRACTORS
HOISTS – DERRICKS
WHIRLERS

Write for descriptive catalogs
McKIERNAN-TERRY CORP.
13 Park Row, New York

MEETINGS

NATIONAL SAFETY COUNCIL, 32nd annual Safety Congress, 20 North Wacker Drive, Chicago, Ill., Oct. 5-7.

AMERICAN PUBLIC HEALTH ASSOCIATION, wartime conference and 72nd annual business meeting, Hotel Pennsylvania, N. Y., Oct. 12-14.

AMERICAN WELDING SOCIETY, 24th annual meeting, Hotel Morrison, Chicago, Ill., week of Oct. 18.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION, Westchester Country Club, Rye, N. Y., Oct. 19-21.

ENGINEERS' COUNCIL FOR PROFESSIONAL DEVELOPMENT, 11th annual meeting, American Society of Civil Engineers, 33 West 39th St., New York, N. Y., Oct. 23.

FEDERATION OF SEWAGE WORKS ASSOCIATIONS, Hotel Sherman, Chicago, Ill., Oct. 21-23.

AMERICAN PUBLIC WORKS ASSOCIATION, Hotel Sherman, Chicago, Ill., Oct. 24, 25, 26 and 27.

REGIONAL AND LOCAL MEETINGS

NEW ENGLAND WATER WORKS ASSOCIATION, Hotel Statler, Boston, Mass., Sept. 28-29.

NEW YORK SECTION, AMERICAN WATER WORKS ASSOCIATION, fall war conference, Hotel Arlington, Binghamton, N. Y., Sept. 30-Oct. 1.

NORTH DAKOTA WATER & SEWAGE WORKS CONFERENCE, Grand Forks, N. D., Oct. 5-7.

SOUTHWEST SECTION, WATER AND SEWAGE WORKS MANUFACTURERS ASSOCIATION, INC., Oklahoma City, Okla., Oct. 11-13.

MISSOURI VALLEY SECTION, AMERICAN WATER WORKS ASSOCIATION, Des Moines, Iowa, Oct. 12-15.

NEW JERSEY SECTION, AMERICAN WATER WORKS ASSOCIATION, joint meeting with Four-States Section, Benjamin Franklin Hotel, Philadelphia, Pa., Oct. 14-16.

WISCONSIN SECTION, AMERICAN WATER WORKS ASSOCIATION, Milwaukee, Wis., Oct. 19-20.

CALIFORNIA SECTION, AMERICAN WATER WORKS ASSOCIATION, Biltmore Hotel, Los Angeles, Calif., Oct. 27-29.

CRASHING THROUGH THE JUNGLES— with the U.S. Marines!

For years, the THORNTON Automatic-Locking DIFFERENTIAL has been proven all over the world in service comparable to its present wartime work. Widely used on wrecking cars, fire engines and other units where extra-ordinary tractive ability is a necessity, it easily and quickly replaces the ordinary differential without essential changes in the vehicle. Wartime experience will make it even more useful in the post-war construction period.

THIS 2½-TON NAVY TRUCK GOES ALONG WITH THE LEATHERNECKS

Here is a fighting truck. Known as the "Marine 6 x 6", it is designed to give tremendous tractive ability under the extremely difficult conditions encountered by the Marines in many parts of the world.

The THORNTON *Automatic-Locking* DIFFERENTIAL replaces the standard type unit in both rear driving axles of this six-wheel drive unit. These differentials eliminate wheel spin and provide positive traction in mud, sand, snow or ice. When one driving wheel is unable to exert tractive effort, the wheel does not spin as it would with the ordinary type of differential. Instead, it locks and the drive is transmitted to the opposite wheel, permitting the vehicle to pull out of difficult situations under its own power. This is invaluable in strenuous service.

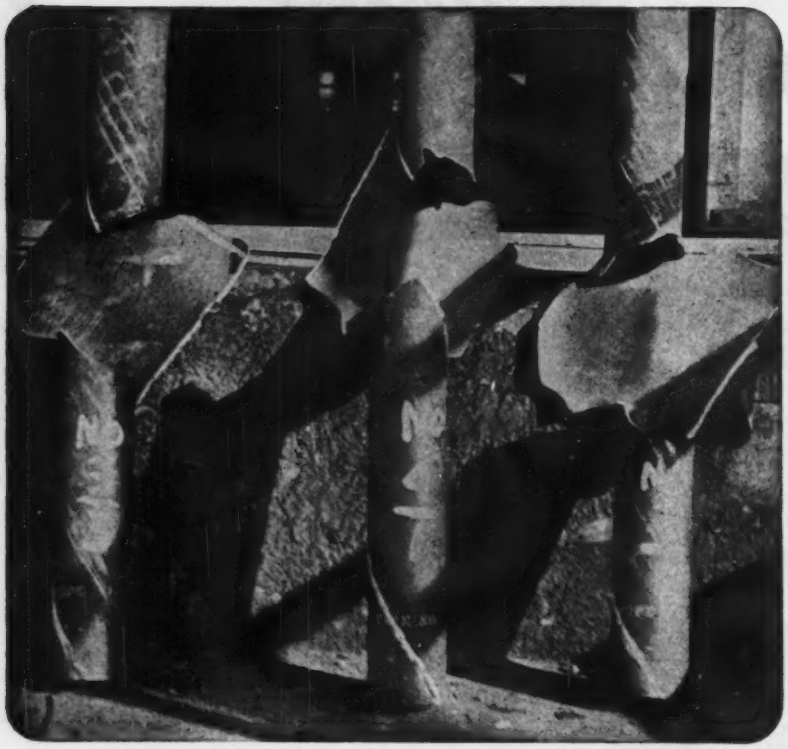
THORNTON TANDEM COMPANY

8701-8779 GRINNELL AVE. - - - DETROIT, MICH.

Manufacturers also of the THORNTON Four-Rear-Wheel DRIVE

"When you need TRACTION you need THORNTON"

Here's proof that ARMCO Spiral Welded Steel Pipe is Shatterproof. Engineers buried these test sections and set off high explosives with the deliberate intention of destroying them. Note the effects of the violent blast; yet the pipe walls only a few inches away are sound and strong.



THIS TEST SAYS STEEL PIPE IS SHATTERPROOF!

Water supply lines take on new importance wherever bombs are likely to fall. It is essential that they resist shock and be easily and quickly repairable. You gain these desirable features with ARMCO Spiral Welded Steel Pipe.

Unlike brittle or low-strength pipe, "Spiral Welded" is shatterproof. It has an ultimate strength of 50,000 to 60,000 pounds per square inch and stretches 25 to 30 per cent before breaking. Even a direct hit causes only localized damage. No digging is necessary to find hidden fractures outside the bomb crater.

There are other advantages of specifying ARMCO Spiral Welded Steel Pipe for water lines. These include low cost, continued high flow capacity and long, easily-handled lengths for quick installation. Write for prices and shipping promises. The American Rolling Mill Company, Pipe Sales Division, 671 Curtis Street, Middletown, Ohio.

ARMCO SPIRAL WELDED PIPE

WATER SUPPLY LINES • PIPE PILES • CAISSONS • LINE PIPE • PREFABRICATED PIPING • DREDGE PIPE

CANADIAN INSTITUTE ON SEWAGE AND SANITATION, annual convention, General Brock Hotel, Niagara Falls, Ont., Oct. 28-29.

CAROLINAS SECTION, ASSOCIATED GENERAL CONTRACTORS OF AMERICA, INC., Pinehurst, N. C., Nov. 1-2.

ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA, fourth annual water conference, William Penn Hotel, Pittsburgh, Pa., Nov. 1-2.

Elections and Activities

Leslie Markovich has been re-elected president of the Milwaukee chapter of the National Association of Home Builders. Clinton R. Taplin was elected vice president, Henry Mollgaard secretary-treasurer, and Arthur J. Daum and James R. Baer directors.

E. P. Cravens, of Austin, has been elected treasurer of the Texas Good Roads Association, succeeding Frank Groos of San Antonio on account of the consolidation of the San Antonio and Austin offices. Oma Ray Walker, of Austin, was elected financial secretary.

Dean Word, contractor of San Antonio, Tex., has been reelected president of the Texas Highway Branch of the Associated General Contractors. George Kies, of Austin, was elected vice president, and Charles H. Newell was reelected secretary-treasurer. Four directors reelected were Tyre Bell, of Austin Road Co., Dallas; W. W. Braden, of Amarillo; J. Rutledge Hill, of Gifford-Hill, Dallas; and H. B. Zachry, Laredo. Newly-elected directors are George Kies, Austin; Holland Page, Austin; J. J. Miles, Fort Worth, and C. Hunter Strain.

The Dallas chapter of the American Society of Civil Engineering met Aug. 2 at Dallas, Tex. Three viewpoints on college wartime training were discussed. E. E. White, president of the society's students' chapter, discussed the students' viewpoint, Lieut. O. Y. Gamel, commander of the Navy College training program at Southern Methodist University, discussed the Navy's viewpoint. University participation was discussed by Sophus Thompson, professor of engineering.

The Engineering Club of Oklahoma City, Okla., has elected the following officers: Ralph Randall, president; J. W. Rogers, first vice president; Frank Herrman, second vice president, and T. E. Graham, secretary-treasurer.

CONSTRUCTION REPORTS

Compiled by Business News Department—Engineering News-Record, 330 W. 42nd St., New York
ELSIE EAVES, Manager *SCOTT McLEOD, Statistician*
(Daily service also available—Write for details)

WATER SUPPLY

PROPOSED WORK

Calif., Long Beach—Los Angeles Co. Flood Control Dist., 751 S. Figueroa St., Los Angeles, Zone 14, City of Long Beach and Los Angeles City Dpt. Water and Power, closure dike across present mouth of San Gabriel River, 900 ft. rock jetty, dredging 300,000 cu. yd. new outlet for river. Over $250,000. M. E. Ramsbury, acting ch. engr. Los Angeles Co. Flood Control Dist., Los Angeles.

★**Ga., Valdosta**—City, extens., expanding water and sewage plant. $900,000. **FWA.** Smith & Gillespie, Realty Bldg., Jacksonville, Fla., engrs.

Kan., Lawrence—H. C. Fisher, city clk., surveys water plant. Black & Veatch, 4706 Broadway, Kansas City, Mo., engrs.

O., Lima—Expansion WW, filtration plant, installing new filters and settling beds. $500,000.

†**Okla., Altus**—T. O. Burch, mayor, water facilities. Okla. 34-179. $63,100. **FWA.** Hudgins, Cobb & Thompson, Altus, engrs. CD 8/10—ENR 8/27.

★**Tex., Fort Worth**—S. H. Bothwell, city mgr., North Side reservoir and water lines. Tex. 41-611. $814,530. **FWA.** J. J. Brady, Majestic Bldg., and Freese & Nichols, Zapps Bldg., engrs. CD 6/10—ENR 6/17.

BIDS ASKED

Bids Asked September 15

N. Y., Brooklyn — Comr. Water Supply, Gas & Electricity, Municipal Bldg., New York 7, watermains, appurtenance E 1, E. N. E. 98, E. 106, Frost and Pine Sts. and Hegeman Ave. Plans deposit $1.

Que., Montreal — Municipality Executive Com., City Hall, replacing pump, unit. Extended date. CD 8/26—ENR 9/2, under Sewers, etc.

LOW BIDDERS

†**Mich., Detroit**—Dpt. Water Supply, E. H. Bauer, secy., 735 Randolph St., Aug. 18, watermains, Mich 39-185, Contr. DM-2, from Birmingham Contg. Co., 301 Hanna Bldg., Birmingham, $53,700. **FWA.** CD 8/12.

N. J., Skillman—S. Miller, Jr., comr. State Dpt., Trenton, Aug. 30, cleaning water supply reservoir, Montgomery Twp., Somerset Co., from A. S. Wikstrom, Bound Brook, $1,778. CD 8/11—ENR 8/19.

CONTRACTS AWARDED

†**Arkansas**—U. S. Eng., 300 Bway., Little Rock, relocating water line, Pulaski Co., to Bush Bros. Constr. Co., 2400 Cypress St., New Orleans, La., $20,000.

†**Florida**—U. S. Eng., 575 Riverside Ave., Jacksonville, Zone 2, water supply line, Neg-Jax-44-139, Pinellas Co., to Boyce Co., Clearwater, under $50,000. Awarded 8/27.

Ia., Des Moines—City, earthern dam for water plant imprvs., to Arthur H. Neumann & Bros., Hubbell Bldg., $333,436. CD 7/13—ENR 7/15.

Miss., Hattiesburg—Bd. City Comrs. and Mayor, City Hall, WW imprvs., 20,000 lin. ft. 2- to 6-in. mains, to Murray Cook Co., Buena Vista, Ga., $29,400. Est. $50,000. J. S. Estes, city engr. Bids 8/25, awarded 8/26. CD 8/17—ENR 8/19.

†**Oklahoma**—U. S. Eng., 416 Wright Bldg., Tulsa, Zone 2, water wells, Contr. 957-eng-644, Oklahoma Co., to Wyatt-Rouner Co., Oklahoma City, $20,000.

SEWERS, WASTE DISPOSAL

PROPOSED WORK

★**Calif., Los Angeles**—City, City Hall, storm drain in Van Nuys Blvd., Van Nuys. $60,000. L. Aldrich, City Hall, engr.

Conn., Hartford—City, Metropolitan Dist., Bureau P. Wks., making plans storm water sewer and drainage ditch in Henry St. $35,000. R. Ross, City Hall, engr.

Ia., McGregor—City, storm sewerage sys. Over $25,000. Stanley Eng. Co., Muscatine, engrs.

O., Canfield—Village, addnl. sanitary sewer lines, rebuilding Canfield sewage disposal plant, $25,000. A. E. Coope, 32 E. Princeton Ave., Youngstown, engr.

R. I., Newport—City, Bd. Health, City Hall, incinerator addn. $25,000. Project held up indefinitely. CD 8/12—ENR 8/19.

†**Texas**—U. S. Eng., 4 and Gold Sts., Albuquerque, N. M., addnl. outfall and pressure sanitary sewer lines, Sol. W. 29-005-Eng-44-1, El Paso Co. Over $25,000.

Location of ENR Correspondents

Symbols and Abbreviations Include:

† Federal Government
★ Project of $500,000 or over
ENR Engineering News-Record
CD Engineering News-Record Construction Daily
A-E-M Architect-Engineer-Management type of contract

Projects—By Size

Construction projects here reported cover the United States and Canada, are of these minimum sizes or larger: water supply, earthwork, waterworks, $15,000; other public works, $25,000; industrial buildings, $40,000; other buildings, $150,000.

Classes of Construction

(Named in order of Listing)

Water Supply	Unclassified
Sewers, Waste Disposal	Latin America
Bridges	Public Buildings
Streets & Roads	Commercial Buildings
Earthwork, Waterways	Industrial Buildings

Stages Reported

PROPOSED: (except Streets & Roads):

BIDS ASKED (new announcements only. For full calendar, see also preceding issues of ENR): LOW BIDDERS: On jobs below $500,000 value all low bidder news will be the final reports published on the projects involved except where award is not made to the low bidder. In this case, a supplementary contract award report will be published.

CONTRACTS AWARDED: Except awards to low bidders previously reported in low bidder stage.

Dates shown are of issue in which last previous report was published.

Note: To comply with censorship requirements, addresses on some reports are being generalized. Data which would reveal the purpose of the improvements and the size are withheld. The name of contractor and general area are reported.

Tex., Houston—Miller-Estes Co., $300 Main St., sanitary sewer collecting lines, 15,000 lin. ft. water lines, natural gas lines, in housing area. Over $25,000. P. G. Willard, Dan Waggoner Bldg., Ft. Worth, engr.

BIDS ASKED

Bids Asked September 15

N. Y., New York—President Bronx Boro, sewer, appurtenances, Lawton and Quincy Aves.; storm water sewer, appurtenances, Rombouts Ave.; grading, building inlets, receiving basins, drains, culverts, approaches, guard rails, Lucerne St.

Bids Asked about September 30

†**O., Canton**—Stark Co., completing sanitary sewer and water lines, in Northeast Sanitary Sewer Dist. $150,000. **FWA.** L. K. Zerbe, Court House, co. engr.

LOW BIDDERS

Calif., Los Angeles—Bd. P. Wks., City Hall, Aug. 25, sanitary vitr. clay sewer, Baird Ave. and Gault St., from Artukovich Bros., 7320 Atlantic Blvd., Hynes, $88,126. Est. $81,271. CD 8/4—ENR 8/12.

†**Tenn., Memphis**—City, completion interceptor sewer, Sect. 1-B, Tenn. 40-242 NF, from Samuel Kraus Co., 637-49 Edmond St., St. Louis 10, Mo., $199,698. **FWA.** Bids 8/31.

CONTRACTS AWARDED

†**Florida**—U. S. Eng., 575 Riverside Ave., Jacksonville, Zone 2, sewer, Neg-Jax-44-148, Pinellas Co., to M. R. Vaughn, 6918 Orange Blossom Ave., Tampa, Zone 4, under $50,000.

†**Massachusetts**—U. S. Eng., 319 Industrial Trust Bldg., Providence, R. I., sewerage treatment sys., exten. facilities, No. 44-18, Hampden Co., to James Munroe & Sons, 160 North Washington St., North Attleboro. Est. $50,000-$100,000. Bids 8/27. CD 8/23.

†**North Carolina**—U. S. Eng., 308 Customhouse, Raleigh, drainage repairs, Iden. 982-44-22, Richmond Co., to F. D. Cline, Fairview Rd., Raleigh, under $50,000.

†**Texas**—U. S. Eng., 25 St. and Avenue F, Galveston, repairing storm drainage, Harris Co., Part 1, to T. D. Howe Const. Co., 3704 Roseland St., Houston, $40,000***Part 2, and reroofing, to Bace-Marshall Const. Co., 4009 Center St., Houston, $50,000 and $100,000 respectively***Part 3, to Linbeck & Dederick, 2117 Gray Rd., Houston, $50,000. Grand total $240,000.

BRIDGES

PROPOSED WORK

Tenn., Jackson—Madison Co., c/o W. T. McMaster, road superv., concrete, steel bridge, abutments near Bemis on Cedar Grove Rd.

BIDS ASKED

Bids Asked September 13

New Jersey—State Hy. Dpt., Trenton, 0.858 mi. grade separation at Port St., Route 25, Sects. 32B and 34A, SN-A-FAP-185A-(1), Essex Co. Plans deposit $10.

Bids Asked September 22

Louisiana—State Dpt. Hys., Baton Rouge, Black Bayou Bridge, approaches, 0.46 mi. long, grading, gravel surfacing, treated timber pile trestle and treated timber sheet pile spillway, S.P. 83-01-02, Caddo Co. $50,000. Plans deposit $3.

CONTRACTS AWARDED

Kentucky—State Dpt. Hys., Frankfort, superstructure and approaches for bridge, etc., Lawrence Co., to Lyons & Breeden, Rogersville, Tenn., $55,677. CD 8/31—ENR 9/2, under LB.

Que., St. Anne Des Monts—5 span, 70 ft. rein.-con. bridge, over St. Anne River, Blvd. Perron, to Gagnon & Cantuer, Jonquiere, about $75,000. CD 6/9—ENR 6/17, under Quebec.

STREETS AND ROADS

BIDS ASKED

Bids Asked September 14

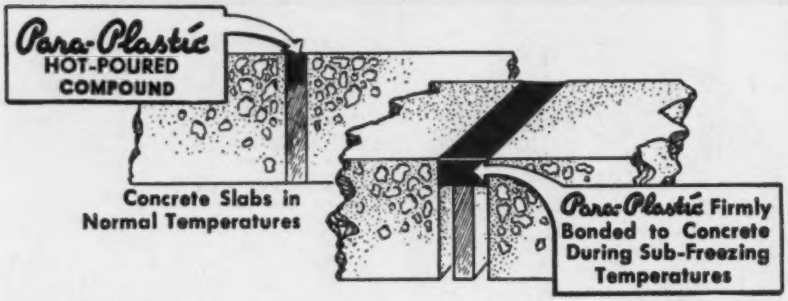
Ohio—State Hy. Dpt., Columbus, grading, drainage structures, bituminous road mix and concrete paving and roadside imprv. 0.45 mi. Sect. B, SH 437, Richland Co., $29,100; applying rock asphalt resurfacing course 2.21 mi., Sect. T of SH 19, US 25, Hamilton Co., $12,819; grading, draining, concrete paving 0.453 mi. Sect. L of SH 52, Ottawa Co., $51,000; widening and asphaltic concrete resurfacing 4.210 mi. Sect. Lancaster of SH 10, US 22, and Sects. A-3, A-3 and Lancaster SH 360, US 33, Fairfield Co., $56,100; bituminous macadam and asphaltic concrete resurfacing 2.582 mi. Sects. G-1 and G-2 of SH 110, US 6, Williams Co., $47,840; asphaltic concrete resurfacing 1.713 mi. Sect. Portsmouth, SH 7, US 52, Scioto Co., $25,500; 1.576 mi. Sect. Cambridge, SH 1, 26 and 352, US 40, 22 and 21, Guernsey Co., $26,800; 1.673 mi. Sects. S-2 and Fayette SH 21, US 20, Fulton Co., $40,400; 0.968 mi. Sect. Wapakoneta, SH 165 and 26, US 33 and 25, Auglaize Co., $30,800; 1.997 mi. Sect. E, SH 113, US 23, Wyandot Co., $20,300; 0.97 mi. Sect. Bucyrus, SH 4, Crawford Co., $18,650.

Bids Asked September 16

Indiana—State Hy. Comn., S. G. Hadden, chn., concrete paving and resurfacing 1.344 mi. U. S. Rd. 6, from west corporation line of Nappanee to southeast, Elkhart Co.; concrete paving 0.545 mi. 14 St., Arrow Ave. to Locust St., and 27 St. from Dunlap Ave. to 25 St., Madison Co.; 1.304 mi. Indianapolis Blvd. from west corporation line to Calumet Ave., Lake Co. Plans deposit $2.75 each project; 0.542 mi. Walnut St. Road, Jackson Co. Plans deposit $1.75; sub-surfacing drainage 9.719 mi. U. S. Rd. 30, from Lake-Porter Co. Line to State Rd. 49, Porter Co.; 6.99 mi. U. S. Rd. 30 from U. S. Rd. 41 in Schererville to west of State Rd. 53; 4.272 mi. U. S. Rd. 30, from west of State Rd. 53 to Lake-Porter Co. line, Lake Co. Plans deposit $2.75 each project; 1.61 mi. erosion control, U. S. Rd. 50, N.E. from Hardinsburg, Dearborn Co.

Para-Plastic

HOT-POURED RUBBER-LIKE
WATERPROOF SEALING COMPOUND



Widely recognized and formerly known as Para-Plastic Hot-Poured Rubber Sealing Compound, "the effective waterproof seal"—Servicised has recently developed a VICTORY PARA-PLASTIC after many months of experimental research.

VICTORY PARA-PLASTIC is composed of non-critical materials, (containing no rubber) and fully conforms with Federal Specifications SS-F-336 covering a hot poured sealing compound; as well as Civil Aeronautics Association Specifications No. P-605

VICTORY PARA-PLASTIC bonds firmly with concrete, steel or wood, and serves as a joint or crevice sealer against infiltration of water. This material is not affected by ordinary extremes of summer or winter weather.

Specify VICTORY PARA-PLASTIC Hot-Poured Rubber-Like Sealing Compound as your water proof protection in general construction.

EXPANSION JOINTS

Servicised also is the only manufacturer of four different available types of Expansion Joints known as Asphalt Joint, Fiber Joint, Cork Joint and Self-Expanding Cork Joint. These Expansion Joints are extensively used in construction of Airport Runways, Highways, Tunnels, Bridges, Dams and other construction.

SEWER PIPE JOINTING COMPOUNDS

In addition, Servicised manufactures several types of waterproof Sewer Pipe jointing materials namely; TUFFLEX—a cold premixed (adhesive and cohesive) plastic troweling compound;—HOT-POURED COMPOUND—for vitrified clay pipe; and PREMOULDED SEWER PIPE BELT—a belt shaped material that is calked between bell and spigot of sewer pipes.

ENGINEERS:

Additional information and Specifications on any of the above products will be furnished you upon request.

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6051 West 65th Street, Chicago, Ill.

UNDERPINNING &
FOUNDATION CO., Inc
Engineers & Contractors
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STREETS and ROADS (Bids Asked. Cont'd.)

Plans deposit $1.75; bituminous coated aggregate and concrete paving 2.092 mi. Scatterfield Rd. from State Road 67 to State Rd. 9, east of Anderson, Madison Co. Plans deposit $2.75. R. Bower, State House Annex, Indianapolis, engr.

Bids Asked September 17

Wisconsin—State Hy. Comm., Madison, 35,900 cu. yd. crushed stone or gravel surface course, Elroy-Wilton Rd., 33,880 cu. yd. Wilton-Sparta Rd., both S.T. Hy. 71, A.F.E. 42-07, Monroe Co.; 14,400 cu. yd. Sect. 1 and 12,440 cu. yd. Sect. 2, Prairie Du Chien-Mt. Sterling Rd., Crawford Co.; 28,000 cu. yd. Kaukauna-Freedom Rd., S.T. Hy. 55, A.F.E. 44-06, Outagamie Co.; 12,000 cu. yd. crushed stone surfacing, Darlington-Mineral Point Rd., S.T. Hy. 23, A.F.E. 23-06, Lafayette Co; 17,800 cu. yd. mine tailings surface course, Platteville-Montfort Rd., S.T. Hy. 80, A.F.E.'s 22-06 and 25-09, Grant and Iowa Counties; 17,500 cu. yd. shale base course, Melrose-North Bend Rd., S.T. Hy. 54, A.F.E. 27-06, Jackson Co.

Bids Asked September 24

Kentucky—State Hy. Dpt., Frankfort, grading, draining, bituminous surfacing 1.461 mi. Speedwell-Moberly Rd., DA-WI-19, SP 76-191, Madison Co.; bituminous surfacing 1.207 mi. East Seventh St., Hopkinsville, SP 24-65, Christian Co.; completing Cumberland River Bridge, addn. of three 30 ft. spans, Loyall-Baxter Rd., SP 48-258, Harlan Co.; 0.344 mi. timber bridge, approaches over Carr's Fork, SP 97-242, Perry Co.

Bids Asked September 24

Tennessee—State Hy. Dpt., Nashville, paving 12.724 mi. section State Hy. 16, beginning at Whitthorne St. and extend. to Moore-Coffee Co. line, AW-FAP-274-B-(2), Bedford and Moore Counties.

Bids Asked

†R. I., Middletown—P. Wks. Dpt., Town Hall, paving, widening, drainage Maple, Beacon Sts. and Chases Lane, RI 37-149, $88,000. **FWA.**

B. C., Victoria—Dpt. P. Wks, c/o Minister, Victoria, reconstructing 6 mi. South Shore Rd., for Province of British Columbia. Plans deposit $10. A. L. Carruthers, Dpt. P. Wks. engr.

LOW BIDDERS

★**†Arizona**—U. S. Eng., 751 S. Figueroa St., Los Angeles, Zone 14, Calif., roads, No. 156, Coconino Co., from Basich Bros., P. O. Box 151, Alhambra, **$600,000-$700,000.** CD 8/11—ENR 8/19.

†Arkansas—U. S. Eng., 300 Broadway, Little Rock, gravel surfacing, clearing, grubbing Rd. 1, hard surfacing Rd. 2, from Cartwright Constr. Co., Walnut Ridge.

California—State Hy. Dpt., 808 State Bldg., Los Angeles, Aug. 26, imprv. 0.5 mi. Los Angeles Co., from Griffith Co., 502 Los Angeles Railway Bldg., Los Angeles, **$25,458.** CD 8/9—ENR 8/12.

Connecticut—W. J. Cox, comr., State Hy. Comn., Hartford, Aug. 30, imprv. 2,550 ft. access road. DA-WI-3(1), Middlebury, from D. V. Frione & Co. Inc., 87 Foxon Rd., New Haven, **$63,736.** CD 8/26.

Idaho—State Hy. Dpt., Boise, Aug. 27, imprv. 2,568 mi. Gowen Field Access Rd., DA-WR-37(1), Ada Co., from J. A. Terteling & Sons, Robert Noble Bldg., Boise, **$135,221.**

Ill., Chicago—City, Dpt. P. Wks., City Hall, Chicago, Aug. 31, concrete paving South Union Ave., W. 33 to 28 Sts., from Chatham Paving Co., 7050 S. Wabash Ave., **$62,973.** CD 8/24.

Maryland—State Roads Comm., Baltimore, Aug. 31, imprv. 0.25 mi. Contract AA 255-13-371, Anne Arundel Co., from T. B. Gatch & Sons, 5928 Belair Rd., Baltimore. **$23,339.** CD 8/25.

CONTRACTS AWARDED

†Colorado—U. S. Eng., 1709 Jackson St., Omaha, Neb., roads and stable reconditioning. Contr. 26-066-eng-38, Eagle Co., to E. S. Harrison, 1787 S. Sherman St., Denver. **$60,000.**

†Florida—U. S. Eng., 575 Riverside Ave., Jacksonville, Zone 2, roads, Neg-Jax-44-65, Sarasota Co., to Marion Contracting Co., Ocala, under **$50,000.** Awarded 8/25.

Idaho—J. D. Wood, acting comr. Pub. Wks. Dpt., Boise, imprv. 7.985 mi. Grace-Preston Hy., SAP 98-B-C-D, Franklin Co., to Hoops Constr. Co., Twin Falls, **$26,238.** Bids 8/25.

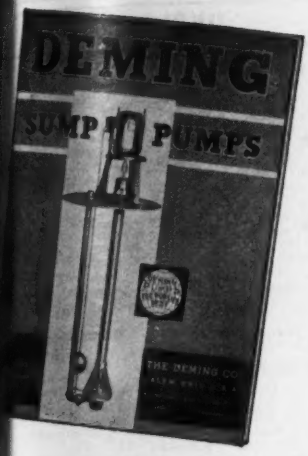
Mass., Newton—City, Street Dpt., City Hall, repairing pavement Beacon St. Owner builds. **$37,500.**

★**Nevada**—State Dpt. Hys., Carson City, grading, surfacing Lyon Co., to Silver State Constr. Co., Fallon, **$233,135;** grading, surfacing area in Lander Co., to Nevada Rock & Sand Co., Inc., Box 1626, Reno, **$345,518.** R. A. Allen, state hy. engr.

†New Jersey—U. S. Eng., 6 and Walnut Sts., Phila., Pa., paving roads, etc., Burlington Co., to Robert Cleveland & Co., 72 N. Park St., East Orange, **$30,000.**

†New Mexico—U. S. Eng., 4 and Gold Sts., Albuquerque, addnl. asphalt paving, Los Cos. to L. Spencer, Alpine, **$36,000.**

★**†Texas** — U. S. Eng., 231 W. Main St., Denison, asphalt and concrete paving, Dallas Co., to Texas Bitulithic Co., 111 W. Commerce St., Dallas, **$742,000.** CD 8/—ENR 8/12, under LB.



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DEMING PUMPS *for War Industries*

STREETS and ROADS (Contracts Awarded, Cont'd.)

Washington—B. Bantz, dir. Hy. Dpt., Olympia, imprv. Primary State Hy. 2, High Point to North Bend, to Washington Asphalt Co., 309 W. 39 St., Seattle, Zone 7, **$134,698.** Bids 8/31. CD 8/25.

EARTHWORK, WATERWAYS

PROPOSED WORK

La., New Orleans—W. T. Burton, Sulphur, dredging channel, installing, maintaining drilling and boiler barge and appurtenant structure for drilling exploratory well for oil production, Orleans Parish.

†**North Dakota**—Bureau Reclamation, Denver, Colo., 5 irrigation projects, being Williston, Nesson, Seneshal, Birdhead and Goodall, on Missouri River, between Williston and Sanish.

Tex., Raymondville—Willacy Co. Water Control & Imprvt. Dist. 1, Raymondville, widening, exten. drainage. $20,000.

BIDS ASKED

Bids Asked September 15

New York—Comr. Parks, at office Dpt. Parks Arsenal Bldg., Central Park, 5 Ave. and 64 St., New York, dredging basin for unloading plant, Great Kills Park, Richmond Boro, Contr. R-16-243.

Bids Asked September 21

†**Arkansas**—U. E. Eng., U. S. Post Office and Courthouse, Vicksburg, Miss., 939,000 cu. yd. or 1,040,000 cu. yd. under alternative plan earthwork on south bank Arkansas River, No. 22-052-44-11.

LOW BIDDERS

†**Arkansas**—U. S. Eng., 300 Broadway, Little Rock, drainage structure at Mill Creek, Dardenelle Drainage Dist., Yell Co., from Ottinger Brothers, Petroleum Bldg., Oklahoma City, Okla.

CONTRACTS AWARDED

†**Fla., Pt. Everglades**—Yards & Docks, Navy Dpt., 18 St. and Constitution Ave., N.W., Wash., D. C., dredging at boat operating station, NOY 6873, to Powell Brothers, Inc., Ft. Lauderdale, **$26,500.**

†**Massachusetts**—U. S. Eng., 31 St. James Ave., Boston, dredging, to Bay State Dredging & Contr. Co., 62 Condor St., Boston; repairing structures, to Columbia Constr. Co., 159 Devonshire St., Boston, both foregoing, No. 19-023-44-Neg 32, Suffolk Co. Est. under **$50 000.** CD 8/26—ENR 9/2.

†**Rhode Island**—U. S. Eng., 819 Industrial Trust Bldg., Providence, dredging, addnl. maintenance work, Newport Co., to Arundel Corp., foot of Fulton St., Brooklyn, N. Y. Est. under **$50,000.**

LEADITE

The Pioneer Self-Caulking Material for C. I. Pipe

TABLE OF COMPARATIVE QUANTITIES

Nominal inside dia. of pipe, in.	Depth of joint, inches of Leadite	Approx. lbs. of Leadite per joint	Depth of joint, inches of lead	Approx. lbs. of lead per joint
4	2.5	2.00	2.25	8.56
6	2.5	3.00	2.25	11.71
8	2.5	4.00	2.25	14.63
10	2.5	5.00	2.25	17.70
12	2.5	6.00	2.25	20.86
14	2.5	7.00	2.25	24.02
16	2.5	8.25	2.25	33.07
18	2.5	9.25	2.25	36.88
20	2.5	10.50	2.25	40.71
24	2.5	13.00	2.50	53.02
30	2.75	16.00	2.50	65.36
36	2.75	19.00	2.50	77.96
48	3.50	30.00	3.00	121.15
54	4.0	38.00	3.00	135.60
60	4.0	42.00	3.00	150.70

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UNCLASSIFIED

PROPOSED WORK

†California—UTILITIES—U. S. Eng. ... New Montgomery St., San Francisco, ... ties, Job. No. 1109, San Francisco Co.

★ **Iowa** — TRACK RELOCATION — Chic... Rock Island & Pacific Ry., F. W. Th... son, ch. engr., LaSalle St. Station, Chic... Ill., 12 mi. track relocation between Per... Station, through Fairfield and Libertyv... $1,500,000.

★ **Texas and Kentucky**—PIPELINE CA... RIER—Tennessee Gas & Transmission C... 3 Natl. Bank Bldg., Nashville, Tenn., 18 ... pipeline carrier (natural gas), between vicin... Corpus Christi, and point in state of Kentucky.

Alaska, Ketchikan—POWER DEVELO... MENT—City, power development at Bea... Falls. $475,000.

Tex., Llano—IMPROVEMENTS—Llano C... imprvs., $100,000.

BIDS ASKED

Bids Asked September 13

B. C., Comox—RADIO STAFF QUARTE... —A. H. McKee, acting secy. Dpt. Transp... Ottawa, Ont., radio staff quarters and rela... works. Plans deposit $25.

Man., Rivers — IMPROVEMENTS — Ar... Secretary, Dpt. Transport, Ottawa, On... addnl. development imprvs. grading, surfac... ing, hard-surfacing taxi strip and apr... construction. About $75,000.

Bids Asked September 21

New York — TRANSIT FACILITIES — ... Transportation, 250 Hudson St., New Yo... changes in transit facilities for imprv. Broo... lyn Bridge and approaches in Manhattan a... Brooklyn Boros.

Bids Asked

†New Hampshire—FENCING—U. S. Eng. ... St. James Ave., Boston, Mass., fencing, W... 19-023-44-NEG 44. Under $50,000.

LOW BIDDERS

†Arizona—IMPROVEMENTS—U. S. Eng. ... 751 S. Figueroa St., Los Angeles 14, Calif... imprvs., No. 157, Maricopa Co., from Unit... Concrete Pipe Corp., Box 1, Sta. H, Los Angeles, Calif., $70,000-$80,000.

†Louisiana—NIGHT LIGHTING SYSTEM... U. S. Eng., 25 St. and Ave. F, Galveston, Tex., Aug. 23, night lighting sys., No. 13-4... C23, Jefferson Co., from Nola Electric, Inc... 826 Baronne St., New Orleans, under $50,0...

†Nevada — IMPROVEMENTS — U. S. Eng... 751 Figueroa St., Los Angeles, Zone 14, Au... 30, imprvs., No. 163, Clark Co., from Gibbo... & Reed, 1250 Carmen Dr., Glendale, $50,0... $60,000.

CONTRACTS AWARDED

†Calif., Mojave—SWIMMING POOL—Yar... & Docks, Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C., swimming pool... Marine Corps Air Sta., NOY 6517, to Jam... I. Barnes Constr. Co., Santa Monica, $107,3...

†Florida—AIR CONDITIONING—U. S. Eng... 575 Riverside Ave., Jacksonville, Zone 2... air-conditioning, Neg-Jax-44-131, Orange Co... to H. A. Daugherty & Co., Orlando, und... $50,000. Awarded 8/25.

†Florida—IMPROVEMENTS—U. S. Eng... 575 Riverside Ave., Jacksonville, Zone 2... imprvs., Neg Jax-44-4, Duval Co., to R. ... McCormick & Sons, Graham Bldg., Jacksonville, Zone 1, under $50,000. Awarded 8/...

†Florida — RECREATION FACILITIES — U. S. Eng., 575 Riverside Ave., Jacksonville, Zone 2, recreation facilities, Neg-Jax-44-... Sarasota Co., to Logan & Currin, Sarasota, under $50,000. Awarded 8/27.

†Louisiana—WHARFS—U. S. Eng., 21 St. and Avenue F, Galveston, Tex., heavy timber wharfs, Orleans Parish, to Stevens Bros. and Miller-Hutchinson Co., 720 Gravier St., New Orleans, $30,000.

†Maine — FACILITIES — Yards & Docks, Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C., addnl. work, facilities, Spec... 12066, NOY 5354, to Stewart & Williams, Inc., and Wyman & Simpson, Inc., 244 Water St., Augusta, $446,000. Additional to CD 2/2... under CA.

†Mississippi—IMPROVEMENTS—U. S. Eng... Grant St., west of Westwood St., Mobile, Ala... imprvs., clearing, Lowndes Co., to Pitts Dou... las & Co., Anniston, Ala., under $50,000.

†Missouri—RANGES—U. S. Eng., 10 E. 1... St., Kansas City, Mo., ranges, Contr. 23-03... eng-30, Phelps Co., to McCarthy Bros. Con... Co., 4903 Delmar St., St. Louis, $30,000.

†Nebraska—IMPROVEMENTS—U. S. Eng... 1709 Jackson St., Omaha, imprvs., bldgs., Box Butte Co., to R. J. McMichael, North Platte. Est. under $50,000.

†Nebraska—IMPROVEMENTS—U. S. Eng... 1709 Jackson St., Omaha, imprvs., bituminous surfacing roads, Clay Co., to Roberts Contr... Co., 1018 Terminal Bldg., Lincoln. Est. under $50,000.

†Nebraska—IMPROVEMENTS—U. S. Eng... 1709 Jackson St., Omaha, imprvs., bldgs., Hall Co., to Winn-Senter Constr. Co., Railway Exchange Bldg., Kansas City, Mo. Est. under $50,000.

Alemite "Sub-Zero" Lubricant Saves Bearings From Ruinous Cold Weather Friction

COLD weather is a deadly enemy of machinery. At 40° below, ordinary lubricants can actually create friction, ruin expensive bearings and parts and put needed machines out of action.

Safeguard your equipment and keep it "rarin' to go" this winter with Alemite Sub-Zero Lubricant. This lubricant is designed for heavy duty work at extreme cold temperatures—*actually protects bearings down to 40° below!* It meets government specifications types "D" and "F" applying to Class-14 of General Schedule of Supplies, U. S. Treasury Department, also U. S. Army specifications.

"Sub-Zero" is one of many Alemite Specialized Lubricants developed to meet out-of-the-ordinary extremes of cold, heat and water. All are proved by years of service to industry. They can help you to meet today's production schedules by prolonging machine life and ending needless breakdowns.

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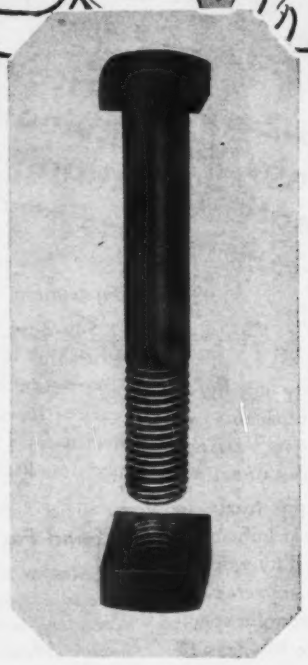
STRONGER—Close-grained metal used; grain structure intensified by bolt-making processes and heat treatment.

TOUGHER—Cold-reduction of shank toughens skin surface for threading.

CLEANER—Threads *cold-worked;* strong, accurate, clean for quick assembly.

QUICKER—Point chamfered (60°) for ease in assembly.

*Up to ⅞" x 8"; larger sizes manufactured by another method.



EMPIRE NUTS*

STRONGER—Hole is punched at *right angles* to grain — no splitting.

TOUGHER—Processed to guard against stripped threads.

CLEANER—Tapping is done with frequently-changed taps.

QUICKER—Accurate tapping means nuts run on fast; counter-boring of hole means quick get-away.

*Regular nuts are processed cold through ⅜".

EMPIRE and allied fastening products since 1845

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Sales offices at Philadelphia, Chicago, Detroit, Chattanooga, Los Angeles, Portland, Seattle

UNCLASSIFIED (Low Bidders, Contd.)

†**Nebraska**—IMPROVEMENTS—U. S. [illegible] 1709 Jackson St., Omaha, Neb., imprvs. including water filter equip., to L. J. Hennigher Co. 15 and Jackson Sts., Omaha, under $[illegible] water storage, to Empire Contractors, [illegible] 901 S. 40 St., Omaha, under $100,000, [illegible] foregoing in Sarpy Co.

†**New Jersey**—DOLPHINS, etc.—U. S. [illegible] 120 Wall St., New York, S. N. Y., dolphins and catwalks, Hudson Co., to Spearin, Preston & Burrows, 50 Church St., New York, N. Y. $50,000.

†**New Mexico**—IMPROVEMENTS—U. S. Eng., 4 and Gold Sts., Albuquerque, improvements bldg., Sol. w29-005-Eng-44-29, Curry Co., to M. G. Bowles, 220 10 St., Lubbock, Tex. $45,000.

†**New York**—APRON—U. S. Eng. Office Bldg., Syracuse, apron, Contr. 321-eng-[illegible] Oneida Co., to John W. Ryan Const. Co. Inc., 369 Lexington Ave., New York, $100,000.

★†**New York**—PARKING AREAS—U. S. Eng., 120 Wall St., New York, Zone 2, parking areas, Contr. 30-075-eng-66, Nassau Co., to Andrew Weston Co. Inc., 158 Irving Pl., Woodmere, $700,000.

†**Oklahoma**—SPRINKLER SYSTEM—U. S. Eng., 416 Wright Bldg., Tulsa, Zone 2, sprinkler sys., Contr. 957-eng-2066, Oklahoma City, to Central Automatic Sprinkler Co., 242 Ashmead St., Phila., Pa. $300,000. Bids 8/2. CD 8/9.

†**Tennessee**—IMPROVEMENTS—U. S. Eng., Grant St. west of Westwood St., Mobile Air Base, imprvs., Coffee Co., to H. E. Wolfe Construction Co., St. Augustine, Fla. and J. B. Michael Co., 1021 Heywood St., Memphis, $65,000. Bids 8/2. CD 7/19—ENR 7/22.

†**Texas**—IMPROVEMENTS—U. S. Engrs., Fort Sam Houston, imprvs., asphalt paving, grassing, Webb Co., to H. B. Zachry Co., P. O. Box 596, San Antonio, $89,000. CD 8/31.

†**Texas**—LOADING RAMPS, etc.—U. S. Engrs., Fort Sam Houston, end-loading ramps at [illegible] bldg. facilities, etc., to Vivrett & Vivrett, [illegible] Southerland Annex, Dallas, $25,000. CD 8/[illegible] —ENR 9/2.

†**Texas**—IMPROVEMENTS—U. S. Engrs., Fort Sam Houston, imprvs., Bexar Co., to R. W. Briggs & Co. and M. B. Killian, Sunset Rd., San Antonio, $275,000.

Tex., Grapevine—OIL WELL—G. Andrews, 3rd, Oil Tower Petroleum Bldg., Dallas, drilling, developing 8,500 ft. test oil well, to R. H. Dearing & Sons, Construction Bldg., Dallas, approx. $25,000. CD 8/7—ENR 8/[illegible]

GOLDEN-ANDERSON

CONE THRU-FLOW VALVE

● Unequalled in efficiency and reliability of operation, the G-A Thru-Flow Cone Valve insures constant uniform service pressure and sufficient capacity to meet varying demands.

Pilot Control, completely self-contained, permits immediate operation.

Rotor assembly operates in oil . . . makes valve operation easy and dependable.

The Cone Valve may be arranged to limit the opening of the plug valve without interfering with its normal closing at any time.

Acceleration of the plug valve cannot occur at the closing point . . . eliminates water hammer or shock in the operation of the valve.

Golden-Anderson Thru-Flow Valves are furnished in sizes ranging from 6" to 30". Get complete information now . . . write today.

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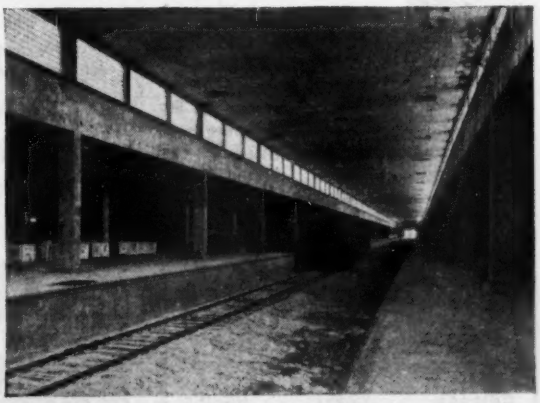
War buildings show rapid progress in **CONCRETE** engineering design

Interior of war industrial plant having 38 and 60-ft. bays spanned by ribbed concrete arch roof. Albert Kahn Associated Architects & Engineers, Inc. Geo. A. Fuller Const. Co., contractor. (Photo courtesy Dodge Chicago Plant, Division Chrysler Corp.)

Hollow, reinforced concrete rigid frames have 150-ft. clear spans in twin National Guard hangars at Des Moines, Iowa. Architect and Engineer, Wm. N. Nielsen; Structural Engineer, Les Forsyth; both of Des Moines.



Large, all-concrete warehouse for Army was designed to permit use of traveling forms to expedite roof construction. Mills, Rhines, Bellman & Nordoff, Toledo, architects; R. C. Reese, Toledo, engineer; Skilken Bros., Columbus, Ohio, contractor.

THESE war buildings demonstrate the rapid progress in design and construction made possible by years of field development and engineering research in concrete.

They indicate something of the wide adaptability of concrete . . . a characteristic equally valuable in postwar construction wherever low first cost, firesafety, durability, strength and low annual cost are desired.

The use of concrete on these projects conserved scarce materials and transportation—the bulk of the concrete materials being available without long freight hauls.

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A national organization to improve and extend the uses of concrete . . . through scientific research and engineering field work

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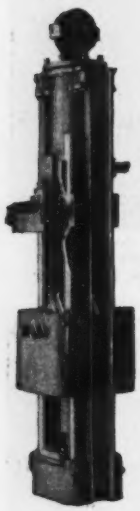
LOW
COST
for upkeep

EASY AND INEXPENSIVE TO OPERATE

WARRINGTON—VULCAN
Single-Acting
STEAM
PILE HAMMERS



In highly successful use for almost 57 years, the Warrington-Vulcan continues to be in wide demand. It is a simple and thoroughly dependable machine that has rapid, regular, and continuous action. It drives any kind of pile—wood, concrete, or steel. It is known by users everywhere for its freedom from mechanical troubles. A quick-acting and wide-opening exhaust prevents back pressure during the fall of the ram so that there is no diminishing of the force of the blow. Write for complete details.

VULCAN IRON WORKS
Since 1852
331 North Bell Avenue
Chicago Illinois

UNCLASSIFIED (Contracts Awarded, Cont'd.)

Tex., Grapevine—OIL WELL—Jesse Martin, L. Brewster & A. L. Moore, W. T. Waggoner Bldg., Fort Worth, drilling, casing, developing new 7,300 ft. test oil well, to Taubert & McKee, Petroleum Bldg., Fort Worth, **$25,000.**

★ **†Texas**—RUNWAYS, etc.—U. S. Eng., 25 St. and Avenue F, Galveston, runways, Contr. 41-154-eng-30, to Cage Bros., and Palmer & Winters, Uvalde, **$500,000**; landing strips, Contr. 41-154-eng-34, to H. B. Zachry Co., Harding Blvd., San Antonio, **$200,000**; both Bexer Co.

†Washington — IMPROVEMENTS — U. S. Eng., 800 3 Ave., Seattle, Zone 4, imprvs., Clallam Co., to A. C. Goerig Constr. Co., 1144 31 Ave. N., Seattle, Zone 2, **$300,000.**

★ **†Washington** — CONSTRUCTION — U. S. Eng., 800 3 Ave., Seattle, Zone 4, construction at military installation, King Co., to Sound Constr., Ford J. Twaits and Morrison-Knudsen Co., Inc., Hoge Bldg., Seattle, over **$1,000,000.**

†Wyoming—IMPROVEMENTS—U. S. Eng., 1709 Jackson St., Omaha, Neb., imprvs., bldgs., Converse Co., to L. D. Liesinger, Casper. Est. under **$50,000.**

†Wyoming—IMPROVEMENTS—U. S. Eng., 1709 Jackson St., Omaha, Neb., imprvs., bldgs., Natrona Co., to Rognstad-Olson Const. Co., Casper. Est. under **$50,000.**

★ **†Canal Zone**—IMPROVEMENTS—Yards & Docks, Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C., **NOY 7420**, completion of NOY 5753, to Williams Bros. Corp., 324 National Bank of Tulsa Bldg., Tulsa, Okla. Additional to CD 11/18—ENR 11/26 under CA.

LATIN AMERICA

Mexico — Mexican Government invited Arthur G. McKee & Co., archts. and contractors, 2300 Chester Ave., Cleveland, O., U. S. A., make preliminary studies, 100 octane gasoline plant. CD 8/26—ENR 9/2.

Mexico, Mexico City—Ministry of Communications & Public Works, Mexico City, c/o E. Suarez, secy. Finance, will construct reservoir, or reservoirs, etc. for flood prevention, force account. Approximately **$2,500,000.** CD 8/26—ENR 9/2.

Venezuela—Colon Development Co., Ltd., Caribbean Petroleum Co., Ltd., subsidiaries of Royal Dutch Shell Co., Caracas, plans expansion oil refinery plants.

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[illegible] St. & River Ave., New York, 51, N. Y.

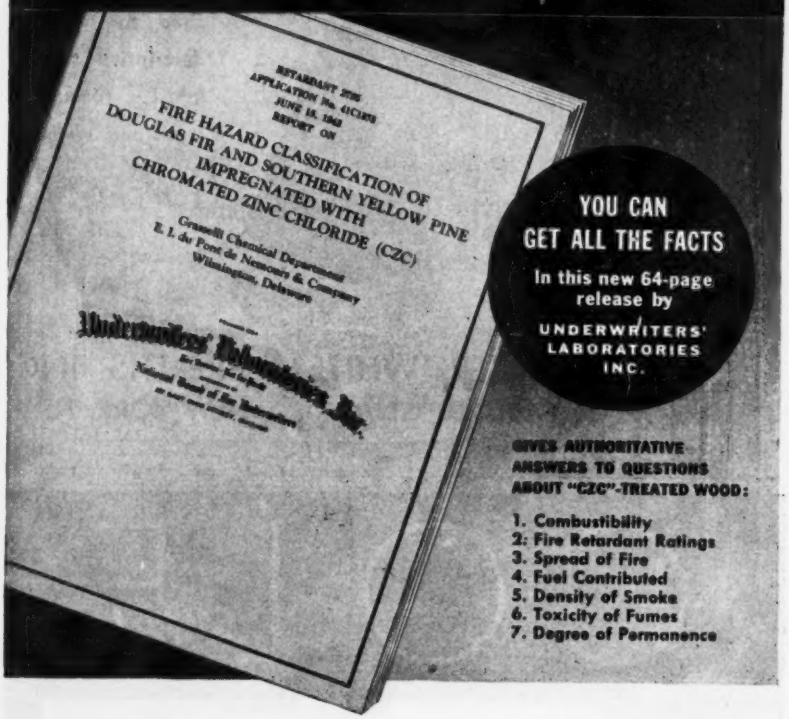
N AMERICA—(Cont'd.)
ezuela—Mene Grande Oil Co., subsidiary
lf Oil Co., Caracas, plans expanding oil
ry plants.

PUBLIC BUILDINGS

POSED WORK
lifornia—Pub. Housing Auth., NHA, 785
et St., San Francisco, plans by Wm. P.
& Associates, Financial Center Bldg.,
Francisco, family dwelling units, Calif.
CD 8/19—ENR 8/26.
lif., Los Angeles—Pub. Housing Auth.,
785 Market St., San Francisco, 500
family housing, Calif. 4766, and 500 unit
housing, Calif. 4769.
lif., Pomona—Los Angeles Co., Hall of
rds, Los Angeles, rebuilding agricultural
at County Fair Grounds. Over $150,000.
Shonerd, Hall of Records, Los Angeles,

lifornia—Richmond City Housing Auth.,
inistration Bldg., Atchison Village, Rich-
d, plans by Miller & Warnecke, 1700
ncial Center Bldg., Oakland, housing,
4763 for NHA. Project formerly in-
ed in Calif. 4751. CD 8/4—ENR 8/12.
lifornia—Richmond City Housing Auth.,
inistration Bldg., Atchison village, Rich-
d, plans by F. H. Reimers, 233 Post St.,
V. G. Raney, 233 Post St., San Francisco,
oup housing, and L. S. Starks, Monadnock
, San Francisco, and L. J. Sharps, 735
Poplar Ave., San Mateo, 1 group housing,
Calif. 4765, for NHA. Project formerly
uded in Calif. 4751. CD 8/4—ENR 8/12.
lifornia—Richmond City Housing Auth.,
inistration Bldg., Atchison Village, Rich-
d, plans by T. L. Pflueger, 530 Market
San Francisco, and C. F. Gromme, Albert
, San Rafael, housing, Calif. 4751 for
A. E. Elmore Hutchison, 58 Sutter St.,
Francisco, engr. CD 8/4—ENR 8/12.
lifornia—Richmond City Housing Auth.,
inistration Bldg., Atchison Village, Rich-
d, plans by A. P. Roller, Crocker 1st
l Bank Bldg. and K. Narbett, 564 Market
San Francisco, housing, Calif. 4762, for
A. Project formerly included in Calif.
CD 8/4—ENR 8/12.
lifornia—Richmond City Housing Auth.,
inistration Bldg., Atchison Village, Rich-
d, plans by E. G. Banga, 605 Market St.,
Francisco, housing, Calif. 4764, for NHA.
ject formerly included in Calif. 4751. CD
—ENR 8/12.
Calif., Richmond—Pub. Housing Auth.,
A, 785 Market St., San Francisco, 600
ilers or portable shelter units, Calif. 4761.
District of Columbia—Pub. Housing Auth.,
A, 19 and D Sts., N.W., Wash., D. C., 740
family housing, D. C. 49100.
District of Columbia and Virginia—Pub.
sing Auth., NHA, Temporary Bldg. 2, 19
D Sts., N.W., Wash., D. C., 260 unit family
sing, D. C.-Va. 44301.
Indiana and Michigan—General Motors
Corp., General Motors Bldg., Detroit, Mich.,
nl. plant facilities in Indiana and Michi-
$5,000,000. Defense Plant Corp. will
nce.
Iowa—Grain Processing Corp., Musca-
ine, addnl. facilities for plant. $270,000.
nse Plant Corp. will finance.
Mich., Muskegon—Pub. Housing Auth.,
A. 2072 E. 9 St., Cleveland, O., 200 unit
ler housing, Mich. 20216.
Massachusetts—Pub. Housing Auth., NHA,
School St., Boston, bids soon 1 story,
0 ft. community bldg., Mass. 19021. M.
ney, 220 Dwight St., Springfield, archt.
1/16—ENR 8/19.
Mississippi—U. S. Eng., Grant St., west of
twood St., Mobile, Ala., cancelled bids to
e been opened September 14, bldgs., out-
utilities, paving, Madison Co. CD 8/24—
R 8/26.
Miss., Grenada—Pub. Housing Auth., NHA.
rgia Savings Bank Bldg., Peachtree and
ad Sts., Atlanta, Ga., 50 unit trailer or port-
shelter units, Miss. 22175.
Mont., Helena—State, veterans and pioneers
morial bldg. $250,000.
Mont., Roundup—1 story, 50x70 ft. office
. $200,000.
Neb., Hastings—Pub. Housing Auth., NHA,
ris Bldg., 1006 Grand Ave., Kansas City,
260 unit family housing, Neb. 25074;
trailers or portable shelter unit housing,
25071.
New Mexico—U. S. Eng., Comr. Bldg.,
uquerque, addnl. bldgs., underground
ities, Otero Co.
N. D., Minot—Trinity Hospital Assoc.,
sp. student nurses' home, N.D. 32-102.
,000. FWA. CD 8/17—ENR 8/19.
N. Mex., Las Vegas—City, Ralph Koble, dir. Pub.
rks, City Hall, 2 story, bsmnt., 45x80 ft.,
ck rein.-con. light plant addn. $40,000.
C. Kanmerer & Associates, 1900 Euclid
g., Cleveland, engrs.
O., Lima—Lima Memorial Hospital Bd.
ustees, C. H. Neville, pres., Lima, elec-
Nov. 2, to vote bonds, brick, rein.-con.
pital addn.
Okla., Warminster—Federal Works Agency,
Park Ave., New York, N. Y., plans by
mchick & Supewitz, 220 S. 16 St., Phila.,
ol. FWA. CD 9/1.
Texas—Pub. Housing Auth., NHA, 1205
ctric Bldg., 7 and Taylor Sts., Fort Worth,
ns by Consolidated Architects & Engi-
rs, 415 Capps Bldg., Fort Worth, and
C. Towns, Amarillo, family stop-gap unit
sing, Tex. 41608. CD 8/27—ENR 9/2.

Report to Engineers on the FIRE-RESISTANCE OF "CZC"-TREATED WOOD



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PUBLIC BLDGS. (Contracts Awarded, Cont'd)

†**Texas**—Defense Plant Corp., 811 Vermont Ave. N.W., Wash., D. C., synthetic rubber ... facilities.

†**Texas**—Pub. Housing Auth., 1349 Electric Bldg., Seventh and Taylor Sts., Fort Worth, plans by Thomas, Sharp, Welch & Goodwin, Construction Bldg., Dallas, housing ... facilities.

†**Washington**—Pub. Housing Auth., NHA, Skinner Bldg., Seattle, Zone 1, plans by J. ... Maloney, Larson Bldg., Yakima, temporary housing.

★†**Washington**—Boeing Aircraft Co., 7... E. Marginal Way, Seattle, addn. facilities for plant. $650,000. Defense Plant Corp. will finance.

†**Wash., Seattle**—Pub. Bldgs. Admin., 18 ... F Sts. N.W., Wash., 25, D. C., plans by ... Bouillon, Thiry & Shay, Hoge Bldg., Zone ... temporary school bldg., Duwamish Bend housing. $158,250.

†**Alaska, Anchorage**—Pub. Housing Auth., NHA, Skinner Bldg., 5 Ave. and Union ... Seattle 1, Wash., 15 unit housing. Alaska 500-70.

†**Alaska, Fairbanks**—Pub. Housing Auth., NHA, Skinner Bldg., 5 Ave. and Union ... Seattle 1, Wash., 10 unit family housing. Alaska, 50071.

BIDS ASKED

Bids Asked September 14

†**Connecticut**—Hartford Housing Auth., ... Asylum St., Hartford, shopping center ... housing Conn. 3-4 for NHA.

Bids Asked September 14

B. C., Masset—A. H. McKee, Dpt. Transport, Ottawa, Ont., power house and garage, ... for Dom. Government, Ottawa, Ont. $75,... G. T. Chillicott, 118 Pacific Bldg., Vancouver archt.

***Bids Asked** September 16*

†**Colorado**—Pub. Housing Auth., NHA, Dierks Bldg., 1006 Grand Ave., Kansas City, Mo., trailers and housing, Colo. 5104 and 5105. T. H. Buell & Co., 730 14 St., Denver archts. CD 8/23—ENR 8/26.

Bids Asked September 17

Ark., Benton—State Hospital Bd. Contract, Little Rock, repairing bldgs. in Benton Colony unit of Arkansas State Hospital for Nervous Diseases. Plans deposit $25. Ginocchio & Cromwell, 219 Hall Bldg., Little Rock, archts. CD 2/10—ENR 2/18 under Postwar Projects.

Wash., Fort Steilacoom—State Dpt. Finance, Olympia, 1 story, 300x400 ft., masonry addn. to Western State Hospital. $275,000. Plans deposit $20, Heath, Gove & Bell, Puget Sound Bank Bldg., and Mock & Morrison, Perkins Bldg., Tacoma, archts.

Bids Asked about September 17

†**Tex., Grand Prairie**—Grand Prairie Ind. School Dist., 140x260 ft. and 110x120 ft. school bldgs., Tex. 41-607. $150,200. FWA. M. Lemmon, Tower Petroleum Bldg., Dallas, archt. F. Chappell, Burt Bldg., Dallas, structural engr. CD 6/14—ENR 6/17

Bids Asked September 19

†**Ariz., Gila Bend**—Pub. Housing Auth., NHA, 785 Market St., San Francisco, Calif., 34 family dwelling units, Ariz. 32261, 30 unit dormitory housing, Ariz. 2327. Extended date. **Lescher & Mahoney**, 1100 Title & Trust Bldg., **Phoenix, archts.** CD 5/24—ENR 8/26.

Bids Asked September 23

†**Kansas**—Pub. Housing Auth., NHA, Dierks Bldg., 1006 Grand Ave., Kansas City, Mo., family housing, Kan. 14136. Extended date. L. Schmidt, 1832 E. 2 St., Wichita, archt. CD 9/3—ENR 9/2.

Bids Asked September 20

†**Calif., Lompoc**—Pub. Housing Auth., NHA, 785 Market St., San Francisco, 144 unit dormitory housing, Calif., 4753. Soule & Murphy, 116 E. Sola St., Santa Barbara, archts. CD 8/20—ENR 9/2.

Bids Asked September 25

†**Calif., Chester**—Pub. Housing Auth., NHA, 785 Market St., San Francisco, 40 unit family dwelling housing, Cal. 4760. L. F. Starkey, Harrison and 9 Sts., San Francisco, archts. CD 8/25—ENR 9/2.

Bids Asked September 28

†**Ind., Evansville**—Pub. Bldgs. Admin., ... and F Sts. N.W., Wash. 25, D. C., 2 and ... story, bsmnt., brick, stone, rein.-con. hospital addn. and nurses' home at Protestant Deaconess Hospital, 614 Mary St. $250,000. **FWA.** Plans deposit $25. Schmidt, Garden & Erickson, 104 S. Michigan Ave., Chicago, Ill., archts. CD 8/24—ENR 8/26.

†**Maryland**—Pub. Housing Auth., NHA, Temporary Bldg. 2, 19 and D Sts. N.W., Wash., D. C., 72 unit dormitory housing, Md. 18262; 120 unit family dwellings, Md. 18263; 200 unit family dwellings, Md. 18264; 100 unit family dwellings, Md. 18265, St. Mary's Co. Extended tentative bid date. L. Justement, 1223 Connecticut Ave. N.W., Wash. 6, D. C., archt. CD 9/3—ENR 8/19.

Bids Asked after September 30

†**Pennsylvania**—Pub. Housing Auth., NHA, 270 Bway., New York 7, N. Y., site improv. for housing, Pa. 36201. Plans deposit $25. Extended date. CD 8/26—ENR 9/2.

†**Pa., Pottstown**—Pub. Housing Auth., NHA, 270 Bway., New York, 7, N. Y., 160 unit family dwellings, Pa. 36437. Extended date. **Thalheimer & Weitz**, Assoc. Archts., 1... Walnut St., Phila., archts. CD 8/26—... 9/2.

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PUBLIC BLDGS. (Bids Asked, Cont'd.)

Virginia—U. S. Eng., Petersburg, bldg., Swiddle Co. $50,000-$100,000.

Bids Asked in September

Connecticut—Pub. Housing Auth., NHA, School St., Waterbury, Mass., family housing. [illegible] 6208. Over $150,000. E. J. Richmond, 3 Grand St., Waterbury, archt. CD 8/20—ENR 8/26.

Bids Asked October 1

Wash., Vancouver—Pub. Bldgs. Admin., [illegible] and F Sts. N.W., Wash., 25, D. C., 5 school bldgs. at McLaughlin Heights, Burton Homes, Bagley Downs, Fruit Valley and Ogden Meadows housing. Extended date. Whitehouse & Roehr and D. J. Stewart, Central Bldg., archts. CD 8/31.

Bids Asked October 5

Calif., Stockton—Pub. Housing Auth., NHA, 785 Market St., San Francisco, 160 unit family dwellings, Cal. 4741; 220 family dwelling unit housing, Cal. 4756; 40 trailer housing, Cal. 4743; 110 unit trailer housing, Cal. 4757; 200 unit family dwellings, Calif. 4742. E. G. Trost, 561 Harding Way, C. Widdows, 327 W. Channel St., J. Losekann, 311 E. Market St., and J. E. Clowdsley, 309 Exchange Bldg., archts. CD 8/25—ENR 9/2.

Bids Asked October 5

Calif., Tracy—Pub. Housing Auth., NHA, 785 Market St., San Francisco, 30 unit dormitory housing, Cal. 4748. J. U. Clowdsley, 309 Exchange Bldg., archt. CD 8/25—ENR 9/2.

Bids Asked October 8

Wyoming—Pub. Housing Auth., NHA, Federal Bldg., 1006 Grand Ave., Kansas City, Mo., housing, community bldg., Wyo-48084. Lander, 507 Insurance Bldg., Denver, mech. engr.-archt. CD 8/11—ENR 8/19.

Bids Asked October 12

Utah—Pub. Housing Auth., NHA, Dierks Bldg., 1006 Grand Ave., Kansas City, Mo., family housing, community bldg., Utah 042. Extended date. Ashton, Evans & Thorgeson, Beneficial Bldg., Salt Lake City, struc.-archts. CD 9/3—ENR 8/19.

Bids Asked October 15

Calif., Eureka—Pub. Housing Auth., NHA, 785 Market St., San Francisco, 320 unit family dwelling units, Calif. 4745. Blanchard, Maher & Ward, 369 Pine St., San Francisco, archts.

Bids Asked October 19

Ga., Augusta—Veterans Admin., Vermont Ave. between H and I Sts. N.W., Wash., D. C., N. P. Infirmary Bldg. 76.

Bids Asked

Fla., Panama City—Pub. Housing Auth., NHA, Georgia Savings Bank Bldg., Peachtree

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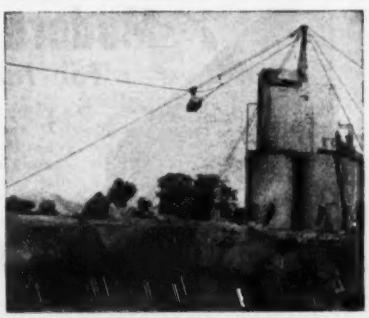

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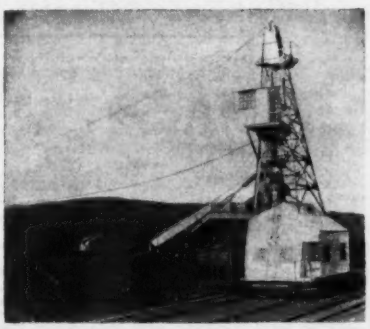

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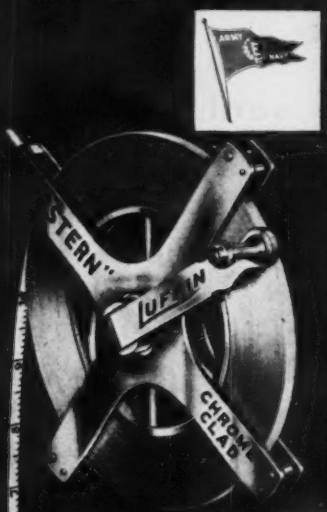

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PUBLIC BUILDINGS (Low Bidders, Cont'd.) and Broad Sts., Atlanta, Ga., 350 utility unit, Fla. 8222. Tentative bid date not set. Ladd Engineering Co., Bona Allen Bldg., Atlanta, Ga., archts.

†**Fla., Tampa**—Pub. Housing Auth., NHA, Georgia Savings Bank Bldg., Peachtree and Broad Sts., Atlanta, Ga., 120 unit family dwellings, Fla. 8227, F. O. Adams, 305 Morgan St., archt.; 500 unit family dwellings, Fla. 8-4, M. Leo Elliott, Citizens Bldg., archt. Tentative bid date not set. CD 8/16—ENR 8/19.

†**Massachusetts**—U. S. Eng., 31 St. James Ave., Boston (selected list bidders), temporary bldgs., No. 19-033-44-Neg-42, Middlesex Co. Under $50,000.

†**N. Y., Buffalo**—Deaconess Hospital, 563 Riley St., hospital addn. $486,000. **FWA.** F. J. and W. A. Kidd, 524 Franklin St., archts. CD 7/9—ENR 7/15.

†**R. I., East Greenwich**—**Federal Works Agency**, 99 Chauncy St., Boston, Mass., two 20x40 ft., and one 50x60 ft., brick USO bldg. addns. $45,000. E. O. Ekman, 60 Natick Ave., Greenwood, archt. CD 8/16—ENR 8/19.

LOW BIDDERS

†**California**—U. S. Maritime Comn., Financial Center Bldg., Oakland, twelve 2 story apartment bldgs., from Biltwell Constr. Co., 4545 Geary St., San Francisco, **$242,800.** W. G. G. Corlett, 1301 Bank of America Bldg., Oakland, archt.

†**Idaho**—Pub. Housing Auth., NHA, Skinner Bldg., 5 Ave. and Union St., Seattle, Zone 1, Wash., Aug. 31, housing, Idaho 10108, from Merrill & Lauch, Helena, Mont., **$166,116.** CD 8/23—ENR 7/29.

★ †**Utah**—Pub. Housing Auth., NHA, Dierks Bldg., 1006 Grand Ave., Kansas City, Mo., Aug. 24, dwellings and temporary dormitories, Utah 42157 and 42158, from Paul Paulsen Co., 55½ W. 1 St., Salt Lake City, Proposals (1), **$493,000** (2) **$510,000.** CD 7/27—ENR 7/29.

†**Washington**—Pub. Housing Auth., NHA, Skinner Bldg., Seattle, Zone 1, Aug. 31, housing, Wash. 45235, from Bergesen, Wick & Dahlgren, Route 1, Box 971, Tacoma, **$170,000.** CD 8/26—ENR 8/26.

CONTRACTS AWARDED

†**Calif., Fairfield** — Pub. Housing Auth., NHA, 785 Market St., San Francisco, 140 family dwelling units, Calif. 4720, to M. J. King, Inc., 231 Franklin St., San Francisco, **$271,327.** CD 7/1.

★ †**California**—Contra Costa Housing Auth., 700 D St., Martinez, family dwelling unit housing, administration bldg., Calif-4713, for NHA, to L. Epp, 4745 Geary Blvd., San Francisco, **$1,696,361.** Bids 8/20. CD 8/31—ENR 9/2 under LB.

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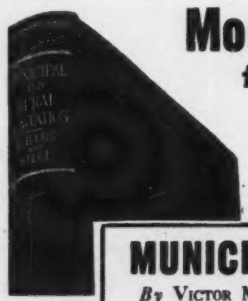

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How to use oiling method against mosquitoes—

How to organize a municipal anti-mosquito campaign—

Essentials of inspecting food-handling establishments—

How to administer housing regulations—

How to treat water in the home—

Sanitary-fill method of refuse disposal—

—*these and scores of similar topics are covered in this book, with the explanations and pointers needed in deciding when, where, and HOW to apply effective sanitary measures.*

Not only are water supply and sewage disposal covered here but also the sanitary methods approved by federal, state, and local authorities for protecting the milk supply—combatting insects and rodents—maintaining healthful and safe standards in housing, schools, industrial plants, swimming pools—etc.

From this book city officials, engineers, inspectors, sanitarians, householders and others in communities of all sizes will get a view of the entire sanitation problem, and of solutions and methods in satisfactory use in many localities, under many conditions, that will aid them in all aspects of effective sanitation administration.

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LIC BUILDINGS (Low Bidders, Cont'd.)

orida—U. S. Eng., 575 Riverside Ave., nville, Zone 2, temporary frame bldgs., Co., to Chalker & Lund, 3900 Georgia West Palm Beach, approx. $200,000. ded 8/30.

orida—U. S. Eng., 575 Riverside Ave., nville, Zone 2, storage magazines, Neg-4-123, Dade Co., to Frank J. Rooney, N.W. 116 S., Miami, Zone 37, under 0. Awarded 8/27.

orida—U. S. Eng., 575 Riverside Ave., nville, Zone 2, bldg., Neg-Jax-44-126, e Co., to Steinert Constr. Co., 5027—14 N., St. Petersburg, under $50,000. ded 8/26.

orida—U. S. Eng., 575 Riverside Ave., nville, Zone 2, storage bldg., Neg-Jax-5, Orange Co., to Steinert Constr. Co., etersburg, under $50,000. Awarded 8/25.

llinois—U. S. Eng., 222 N. Bank Dr., hicago, bldg., to J. W. Snyder Co., 307 N. gan Ave., Chicago, $437,900; 2nd sect. to Paschen Bros., 221 N. La Salle St., go. Over $1,000,000. Bids 8/20. Both fore-Cook Co. CD 8/11.

nsas—Pub. Housing Auth., NHA, Dierks 1006 Grand Ave., Kansas City, Mo., ings, Kan. 14134, to Busboom & Rauh, S. Santa Fe St., Salina, $246,000. Bids CD 7/30—ENR 7/22.

uisiana—U. S. Eng., 25 St. and Avenue Galveston, Tex., storage construction, on Parish, to Armco Metal Products Co., e Metal & Culvert Div.), Forsyth Bldg., nta, Ga. under $50,000.

Maryland—Revere Copper & Brass Inc., 0 Park Ave., New York, N. Y., manufac-y plant, to Jas. Stewart & Co., 230 Park New York, N. Y. Est. $6,000,000. De-Plant Corp. will finance.

Md., Bainbridge—Yards & Docks, Navy pt., 18 St. and Constitution Ave. N.W., D. C., addnl. housing Naval Training on, NOY 6725, to John McShain, Inc., 17 pring Garden Sts., Phila., Pa., $1,987,000. 8/23. CD 8/26 under LB.

Nebraska—Pub. Housing Auth., NHA, ierks Bldg., 1006 Grand Ave., Kansas Mo., family housing dormitory bldgs., itory facilities bldg., community bldg., cafeteria bldg. attached, field construc-ffice, Nebr. 25072 and 25073, to Francis rshek Co., Fisk Bldg., Amarillo, Tex., al 3, $637,706. Bids 8/27. CD 8/30—9/2 under LB.

Y., Sampson—Yards & Docks, Navy 18 St. and Constitution Ave. N.W., D. C., grading, U. S. Naval Hospital, 6147, to Blades Constr. Co., Hornell, 411.

eb., Bruning—Pub. Housing Auth., NHA, ks Bldg., 1006 Grand Ave., Kansas City, 120 unit housing, Neb. 25064, to M. W. on. Nat'l. Bank of Topeka Bldg., To-Kan., $291,363. Bids 7/23. CD 6/21—6/24.

eb., Geneva—Pub. Housing Auth., NHA, ks Bldg., 1006 Grand Ave., Kansas City, 120 unit housing, Neb. 25067, to M. W. on. Nat'l. Bank of Topeka Bldg., To-Kan., $272,657. Bids 7/23. CD 6/21—6/24.

ew Mexico—U. S. Eng., 4 and Gold Sts., uquerque, bldg., Bernalillo Co., to Lembke r. Co., 324 N. 3 St., Albuquerque, 0. Bids 7/24. CD 7/15.

exas—U. S. Eng., 231 W. Main St., Deni-addnl. facilities in shop area, Moore Co., S. Moore, Ada, Okla. $48,000.

exas—U. S. Eng., 25 St. and Avenue F, eston, bldgs., Sol. 359-44-C4, Brazos Co., mith Building Co., Box 796, Waco, $60,000. 8/9.

Texas—Humble Oil & Refining Co., Hum-le Bldg., Houston and Baytown, hydro-e & Webster Eng. Corp., 49 Federal St., ston unit at gasoline refinery plant, to on, Mass., and Baytown, Tex., $2,000,000. rally financed.

ex., Corpus Christi—Yards & Docks, Navy 18 St. and Constitution Ave. N.W., Wash., physical training facilities, NAVTC, NOY to J. A. Sharrock, Hooks, $319,300.

Utah, Clearfield—Pub. Housing Auth., NHA, Dierks Bldg., 1006 Grand Ave., as City, Mo., 60 unit family housing, 42156, to Robert E. McKee, 4700 San ando Rd. W., Los Angeles, Calif., $957,000. 7/19. CD 7/26—ENR 7/29 under LB.

Washington—U. S. Eng., 800 3 Ave. tle, Zone 4, bldgs., Spokane Co., to Sound str. & Eng. Co. and F. J. Twait, Northern Tower, Seattle, Zone 1, $50,000.

Wash., Seattle—Pub. Housing Auth., NHA, mer Bldg., 5 Ave. and Union St., Zone 1, unit housing, Wash. 45229, to James rnes Constr. Co., Smith Tower, $319,000. 8/3. CD 7/31—ENR 7/8.

Wash., Seattle—Port of Seattle, Bell St. Terminal, Zone 1, two 1 story, 110x980 ft. nit sheds, Connecticut St. Terminal, to stern Constr. Co., Arctic Bldg., Seattle, 4, $561,157. Bids 8/23. CD 8/31—ENR under LB.

a., Edmonton—Dpt. Munitions & Supply, wa, Ont., accommodation North West ing Route, to Bennett & White Constr. Ltd., 6 James Richardson Bldg., about 00.

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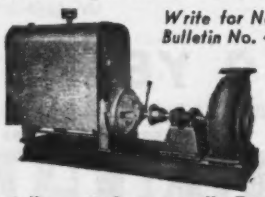

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PROPOSED WORK

Calif., Gardena—Newman Corp., c/o L. Jones, archt., 154 W. 7 St., Los Angeles, frame, stucco dwellings. Over $150,000.

O., Cleveland—2530 North Moreland c/o C. Bernstein, Hippodrome Bldg., plans G. H. Burrows, 3113 N. Moreland Blvd., 2 story, bsmnt., brick apartment $400,000.

★ **O., Cleveland**—Shaker Square Apartments Co., c/o Don Loftus, Marshall Bldg., pla by G. H. Burrows, 3113 N. Moreland Blvd fifteen 2 story, bsmnt., brick apartment bldg $1,500,000.

O., Maple Heights—Model Building Co., Barrish, 3321 E. 149 St., Cleveland, forty-nine 1 story, bsmnt., 25x29 ft., brick hom $294,000.

Tex., Brownsville—Thos. Joseph, Embe Bldg., Harlingen, thirty-five 1 story, shestro textstone dwellings, concrete fdns. $200,000.

★ **Tex., Houston**—Meadowbrook Building Co., 8199 Howard Dr., 101 frame type dwel ings, concrete fdns. $500,000.

★ **Tex., Houston**—Miller-Estes Co., 3200 Ma St., plans by P. G. Willard, Dan Warren Bldg., Ft. Worth, three hundred and four story, frame type dwellings, concrete fdn $1,250,000.

Tex., Pasadena—Brick Homes, Inc., Pas dena, plans by J. Knostman, 2017 W. Gra St., Houston, sixty 1 story dwellings, $350,0

★ **Wash., Seattle**—Puget Sound Bridge Dredging Co., 2929 16 Ave. S.W., Zone plans by Stuart & Durham, 4 and Cherr Bldg., Zone 4, 230 homes, near Lake Burie south of here. $1,250,000.

★ **Wash., Spokane**—Carroll, Hillman & Hu lund, Old Times Bldg., Seattle, Zone 1, 1 houses, Glenwood and Boulevard Park Addn to Waale-Camplan Co., 2100 S. W. Jeffers St., Portland, Ore., $3,300,000. Stuart & Du ham, 4 and Cherry Bldg., Seattle, Zone archts. CD 8/2—ENR 8/5.

BIDS ASKED

Bids Asked September 16

Ill., Chicago—Provident Hospital & Tra ing School Assoc., 462 E. 21 St., 1 story ternes quarters bldg. and hospital. $80,0 E. A. Grunsfeld, Jr., & Denison B. Hull, N. Michigan Ave., archt.

LOW BIDDERS

★ **Tex., Goose Creek**—Tejas Development Co Goose Creek, 150 dwelling units and stree from McGough Bros., Bankers Mtge. Bldg Houston; sewerage and water sys., from Hab Constr. Co., Commerce Bldg., Houston, $500,000. FHA. CD 8/23—ENR 8/26

CONTRACTS AWARDED

Calif., Gardena—Apex Building Co., 40 Exposition Bldg., Los Angeles, 50 frame ty duplex dwellings. Owner builds. Over $15 000. R. S. Loring, 7411 Beverly Blvd., L Angeles, archt.

★ **Calif., Inglewood**—Sunset Operating Co 5507 Ashworth St., Bell Flower, 374 fram stucco dwellings. Owner builds. Ov $1,000,000. Matcham & Hetschmidt, 407 Hill St., Los Angeles, archts.

★ **Conn., Southington**—Berkley Homes, In Berlin St., 135 frame type dwelling uni Berlin, Odell and Taunton Sts., Berkley an Homesdale Aves. Owner builds. $000,0

O., Cleveland—Carl Krueger, 2145 Linco Ave., Lakewood, thirty-six 1 story, bsmt 25x29 ft., brick homes. Owner does mason and carpentry work. $216,000.

O., Cleveland—Merrian Homes, Inc., c/o Seymour, Union Commerce Bldg., twenty-o 2 story, bsmnt., duplex brick dwellings. H. W. Steinhoff, 3641 Fulton Rd. $231,000.

Tex., Houston—Barbee Apartments, Inc., Blk. Barbee St., four 2 story, brick ven apartment bldgs., concrete fdns., to L. P. Mc Kenzie, 4425 Roseneath St., approx. $150,0 CD 8/25—ENR 9/2.

Tex., Houston—Honerkamp Lumber Co., Dr ver Addn., Houston, forty 1 story, frame, a bestos dwellings. Owner builds. Approx. $75 000. J. Knostman, 2017 W. Gray St. CD 8/ —ENR 9/2.

Ont., Toronto—Allen Industries Estates Ltd Box 595, Etobicoke, 39 dwelling units, ow Parklawn Ave. and Queensway, owns form $168,000. W. Bazely, c/o owner, supt. cons

Ont., Windsor—Salvation Army, 20 Alber St., Toronto, 4 story, bsmnt., 60 bed addn to Grace Hospital, 329 Crawford St., to R. Wilson Ltd., 341 Tecumseh Blvd. E., appro $150,000. CD 8/23—ENR 8/25.

INDUSTRIAL BUILDINGS

PROPOSED WORK

California—PLANT—Hughes Aircraft Co Florence Ave. and Teale St., Culver City plans by H. L. Gogerty Organization, 12 N. Vine St., Hollywood, 170x360 ft. wo frame fabrication and assembly bldg. Ow $40,000.

Minn., Mankato — FACTORY — Continued

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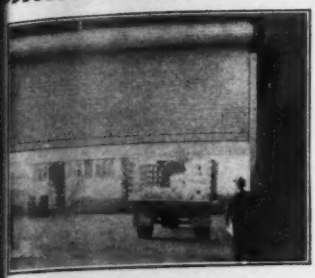

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LIC BUILDINGS (Low Bidders, Cont'd.)

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Ord—MILL—Saunders Mills, Inc., Boston Ave., Toledo, O., alfalfa mill. Over 000, incl. equip.

ash., Seattle—PACKING HOUSE—Frye & 2203 Airport Way, Seattle, Zone 4, soon contract 4 story packing house, $200,000. chien, Everds & Crombie, 59 E. Vanburn Chicago, Ill., engrs.

S ASKED

H., Keene—FACTORY—New England w Co., Emerald St., brick factory, off rald St. Over $40,000. Waghorne-Brown 44 School St., Boston, Mass., engr.

T BIDDERS

d, Relay—PLANT—J. E. Seagram & Sons. Rd., Louisville, Ky., Aug. 26, conversion et bottling bldg. into personnel bldg., at ert Distillery, from Frantz Constr. Co., 10 Chase St., $42,490. Bids 8/26. CD 9/2.

TRACTS AWARDED

lif., Berkeley — LABORATORY — Cutter oratories, 4 and Parker Sts., design and conction 1 and 2 story, bsmnt., 60x200 ft., n. rein.-con. laboratory bldg., to Austin 1002 Ray Bldg., Oakland. Est. $400,000.

v., Sparks—SHOP—Southern Pacific Co., H. Kirkbride, ch. engr., 65 Market St., Francisco, Calif., 90x250 ft., steel frame motive erecting shop bldg., to Robert E. Mc- 4700 San Fernando Rd. W., Los Angeles, approx. $200,000.

J., Garwood—FOUNDRY—Aluminum Co. America, South Ave., 1 story, magnesium dry addn., brick, to Wm. Blanchard & Co., Poinier St., Newark, $45,000. CD 8/9—ENR

J., Jersey City—GARAGE—Swiss Ameri- Gear Mfg. Co., 110 Hoboken Ave., brick, rete garage and mfg. bldg. addn., to B. arelli & Co., 20 Orchard St., $40,000. W. mann & Son, 587 Summit Ave., archts.

x., Mercedes—PLANT—Rio Banco Farms, Illinois St., bldg., facilities for vegetable citrus packing and shipping. Owner builds. 00, CD 8/30—ENR 9/2.

x., Pharr—PLANT—M. Weisfeld, Pharr, ery citrus and vegetable packing plant, rete. Owner builds, $40,000.

, B., Moncton—GARAGE, etc.—Lounsbury Ltd., 650 Main St., garage and repair shop.

Proposal Advertisements see p. 206
Postwar Projects see p. 178

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(U. S. Government)

Public Roads Administration, Federal Works Agency, Arlington County, Virginia, August 25, 1943, SEALED BIDS will be received at the office of the District Engineer, Public Roads Administration, 1440 Columbia Pike, Arlington, Virginia, until 10:00 o'clock, a.m., E.W.T., Sept. 15, 1943, for the construction of access road, Project VA DA WR-21 Paving 51, Henry G. Shirley Memorial Highway, Arlington and Fairfax Counties, Virginia. The approximate quantities of the more important items are as follows: 12,100 Cu. Yds. of Excavation; 20,000 Sq. Yd. Plain Cement Concrete Base Course; 2,900 Tons Cold Asphalt Concrete Pavement; 26,000 Sq. Yds. Reinforced Cement Concrete Pavement, and 13,000 Sq. Yds. Plain Cement Concrete Pavement. Minimum rates of wages for laborers and mechanics on this project will be fixed by the Secretary of Labor as required by law. Plans, specifications and proposal forms may be obtained at the address given above. H. J. Speiman, District Engineer. (173)

UNITED STATES DEPARTMENT OF THE INTERIOR, Bureau of Reclamation, Washington, D. C., August 25, 1943. Sealed bids (Specifications No. 1053) will be received at the office of the Bureau of Reclamation, Yakima, Washington, until 10 a.m., September 27, 1943, and then publicly opened, *for furnishing labor and materials and performing all work for the construction of earthwork, concrete lining, and structures*, from station 2884+75 to station 3314+40, and wasteway No. 5 station 3353+34.73 Yakima Ridge Canal, Roza division, Yakima project, Washington. The work is located six miles northwest to one mile east of Sunnyside, Washington. The principal items of work and the estimated

(U. S. Government)

quantities involved are as follows: 3,000 cubic yards of excavation, common, for canal; 2,200 cubic yards of excavation, common, for lined canal section; 400 cubic yards of excavation, rock, for lined canal section; 700 cubic yards of excavation, common, for structures; 85,000 cubic yards of excavation, common, for wasteway sections and structures; 500 cubic yards of excavation, rock, for wasteway sections and structures; 200 cubic yards of compacting embankments; 10,200 station cubic yards of overhaul; 3,200 square yards of preparing rock foundations for concrete lining; 10,000 square yards of trimming earth foundations for concrete lining; 34,700 cubic yards of backfill; 3,350 cubic yards of puddling or tamping backfill; 2,620 cubic yards of concrete in structures; 1,500 cubic yards of concrete in canal lining; 8,900 cubic yards of concrete in wasteway channel and transitions; 1,200 square yards of dry-rock paving; Placing 488,000 pounds of reinforcement bars; Erecting 20 M ft. b.m. timber in structures; Placing 7,175 pounds of metal water stops in joints; Installing 70 square feet of elastic joint-filler materials; Installing 32 linear feet of rubber water stops; Constructing 2,000 weep holes; Constructing 12,350 linear feet of 6-inch diameter underdrains with uncemented joints; Laying 1,000 linear feet of 6-inch diameter sewer pipe with cemented joints; Installing 22,000 pounds of gates and gate hoists; Installing 3,000 pounds of blow-off valves and connections; Installing 1,000 pounds of miscellaneous metal work; Installing 190 linear feet of electrical metal conduits; and Installing 20 pounds of electrical ground wires. The work is work permitted by the War Production Board and applica-

(U. S. Government)

tion has been made for a suitable priority. A supplemental notice to bidders will be issued when action has been taken on the application for priority. This invitation for bids does not cover the purchase of materials which are to be furnished by the Government. Materials to be furnished by the contractor and those furnished by the Government are described in the specifications which will be a part of the contract. The work shall be commenced within thirty (30) calendar days after date of receipt of notice to proceed and various parts of the work shall be completed within the period of time from one hundred and sixty (160) to three hundred and fifty (350) calendar days from the date of receipt of such notice, as provided in the specifications. Guarantee will be required with each bid in an amount not less than 10 percent of the amount bid. Performance bond will be required in an amount not less than 50 percent of the estimated aggregate payments to be made under the contract. Payment bond will be required in the sum of one-half of the total amount payable by the terms of the contract. Liquidated damages for delay will be fifty dollars ($50) per day for each uncompleted part of the work for which a separate period of time for completion is provided in the specifications. Partial payments will be made monthly. No charge to prospective bidders for copies of the specifications and drawings; to others, $2.00 per copy, not returnable. For particulars, address the Bureau of Reclamation, Yakima, Washington; Denver, 2, Colorado; or Washington, 25, D. C.

H. W. BASHORE,
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(175)

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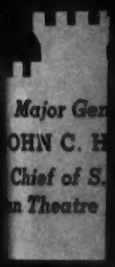

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